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ABSTRACT

These eight modules for an industrial orientation class were developed by a project to design an interdisciplinary program of basic skills training for disadvantaged students in a Construction Technology Program (see Note). The Drafting module overviews drafting career opportunities, job markets, salaries, educational requirements, and basic drafting skills. The Mechanics module covers mechanics' terminology, tools, work environments, and basic automobile maintenance procedures. In the Construction module the basic concepts, terminology, tools, materials, and methods used in wood frame construction are introduced. The Machine Shop module covers working with machine tools. The Welding module concerns safety, fundamental principles, equipment, and procedures. Topics in the Industrial Environments module include characteristics, tests and resources, women and work, sex stereotype information quiz, apprenticeship, discriminatory interview questions, and cognitive mapping. The Blueprint Reading module covers building and cartographic blueprints and symbolic language and terminology of blueprints. The Woodshop module covers equipment use, terminology, story rod, and using blueprints to build a woodshop project. Electrical concepts and terminology are introduced in the Electronics module which also provides practice using electronic components and equipment, making simple electrical repairs, making a circuit tester, and doing household wiring. (Related jobs are listed on the first page of each module. Hands-on projects are included in most modules.) (YLB)

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INDUSTRIAL ORIENTATION

Lane Community College

CE025911

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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LANE COMMUNITY COLLEGE

INDUSTRIAL ORIENTATION

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DRAFTING

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INTRODUCTION

The Drafting module of Industrial Orientation is designed to give you a brief overall look at drafting careers. We want you to see both the good and the bad points of being a drafter. We will cover such topics as career opportunities, job markets, salaries, and educational requirements as well as learn basic drafting skills in class. Your questions are encouraged and will be answered in class.

You will receive hands-on experience as you draw plans of a nightstand to be built in the Woodshop module and a screwdriver to be made in the Machine shop module.

RELATED JOBS

ARCHITECTURAL DRAFTSPERSON

ARCHITECTURAL DESIGNER

AUTO-BODY DESIGNER AND LAYOUT DRAFTSPERSON

CABLE LAYOUT PERSON

CARTOGRAPHER

COMMERCIAL DRAFTSPERSON

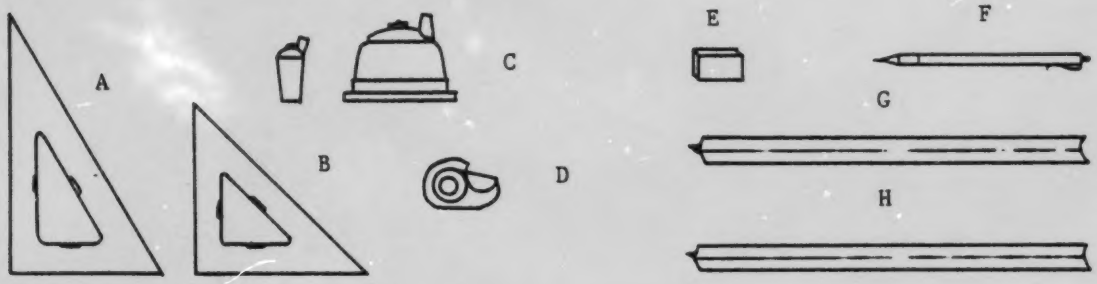
OIL AND GAS MECHANICAL DRAFTSPERSON

PLUMBING DRAFTSPERSON

REFRIGERATION DRAFTSPERSON

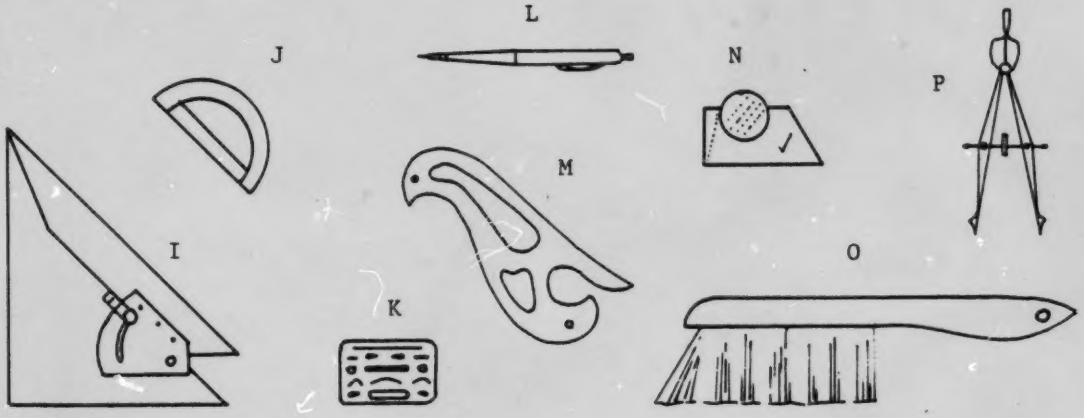
TECHNICAL ILLUSTRATOR

EQUIPMENT PROVIDED



A. 30° x 60° Triangle
B. 45° Triangle
C. Sharpener
D. Drafting tape
E. Eraser
F. Lead holder and lead (3H or 4H recommended)
G. Triangular architects scale
H. Triangular engineers scale

OTHER EQUIPMENT AVAILABLE



I. Adjustable triangle
J. Protractor
K. Erasing shield
L. Automatic pencil with sized leads
M. French curve
N. Ames lettering guide
O. Dusting brush
P. Compass

Not shown: Templates of different geometric shapes available in English or Metric measurements.

THE FOUR OBJECTIVES

1. ACCURACY To become proficient in drafting skills you must maintain a high standard of accurate reproduction work. This is important in the classroom as well as on the job.
2. SPEED Speed as well as accuracy is important, especially in the business world. The sooner the product is completed, the more money the employer saves. But, remember that speed is built as you learn the skills; you are not expected to have speed as a beginning student.
3. LEGIBILITY Drafting is a pictorial form of communication, and more than many other forms of communication must be done clearly and precisely or it will not be understood and applied correctly.
4. NEATNESS This is the combination of accuracy speed, and legibility plus presentability. An employer will always prefer work that is clean and well presented over work that is smudged and careless.

EQUIPMENT PROVIDED

A. 30^{o} x 60^{o} triangle

B. 45^{o} triangle

These triangles are made of clear plastic to allow better visibility during use. They are used for drawing horizontal, vertical and inclined lines. Ask your instructor for directions about testing for warpage and true angles.

C. Sharpener---see diagram.

D. Drafting tape---Most drafters prefer this tape to cellophane tape because it does not damage the board or the paper when it is used and removed.

E. Eraser---There are many types of erasers available. Each has a different degree of abrasiveness and hardness. The Weldon Roberts India or the Eberhard Faber Ruby are used in general drafting for erasing both pencil and ink. The Artgum

is used for general clean-up and removal of pencil lines from under ink.

F. Lead holders and lead---A lead holder allows you to use different leads as needed. Leads vary from hard (the H range) to medium (HB) to soft (the B range).

G. Triangular architects scale---see diagram.

H. Triangular engineers scale---see diagram.

OTHER EQUIPMENT AVAILABLE

I. Adjustable triangle---Combines the functions of triangles and the protractor for more variety and flexibility in use.

J. Protractor---A protractor is used for measuring or setting angles other than 30°, 45°, 60°, or 90°. A plastic protractor is the cheapest and is satisfactory for general work.

K. Erasing shield---This is usually a metal plate with different shapes of holes cut into it. When it is placed so that the hole exposes the section of work to be erased the rest of the work is protected.

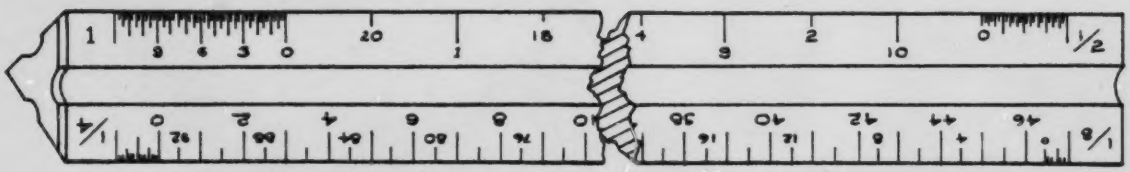
L. Automatic pencil with sized leads.

M. French Curve---These curves are made of clear plastic for good visibility. They are used to draw mechanical curves other than circular arcs or arcs and are available in a variety of shapes and sizes.

N. Ames Lettering Guide---Used for uniform lettering.

O. Dusting Brush---This brush is used for removing eraser crumbs from the drawing without causing smears.

P. Compass---There are two types of compasses. The traditional style and the giant bow style. Both have one leg with a socket joint that allows pen or pencil attachments to be inserted. The giant bow is most often used for production drafting when dark, clean lines are needed for accurate, legibile reproductions.

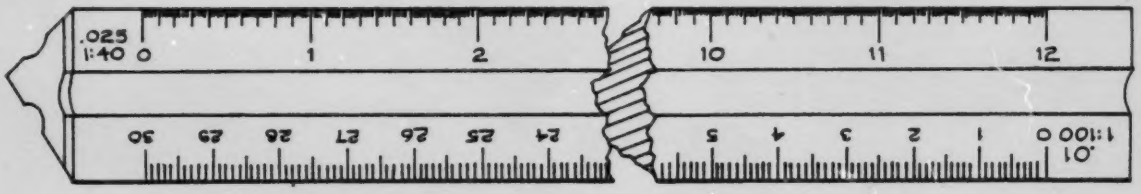


FULL SCALE

1" = 1'-0"

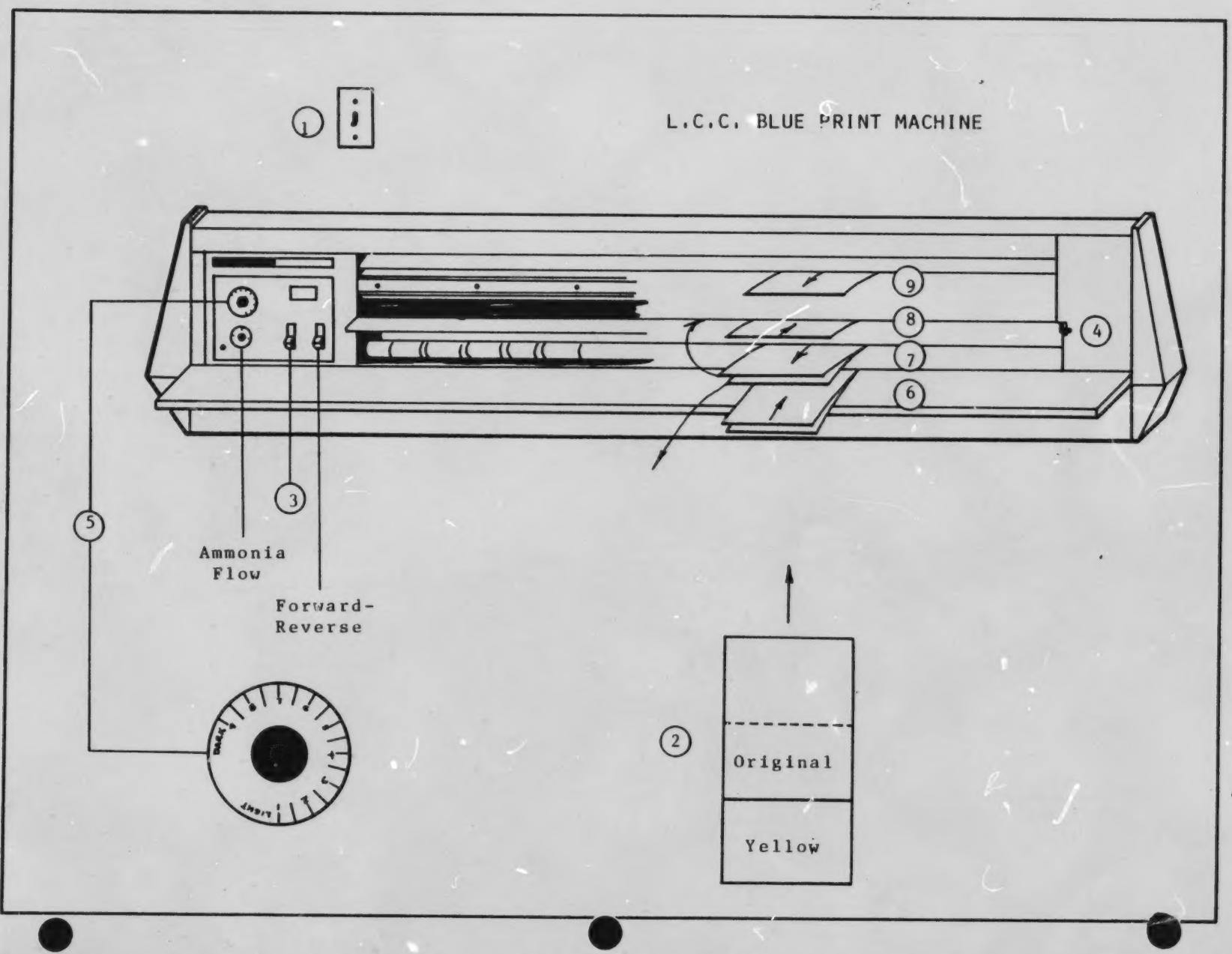
ARCHITECTS SCALE

The architects scale consists of one full-size scale and ten overlapping reduced-size scales. In this illustration only four scales are shown. In all the reduced scales the major divisions represent feet. Thus the subdivisions represent inches and fractions. For example, the 1 scale means 1 inch = 1 foot. Therefore the top scale is shown full size while the bottom scale is drawn to the 1 scale.



ENGINEERS SCALE

The engineers scale uses the metric system and has the advantage of the decimal system which eleviates fractions. It consists of six reduced-size scales. To understand this scale it is advised that you become familiar with the metric system.


L.C.C. BLUE PRINT MACHINE
1
2
Original
Yellow
3
Ammonia
Flow
Forward-
Reverse
4
5
6
7
8
9
DARK
LIGHT

9

11

12

HOW TO USE THE BLUE PRINT MACHINE

(1) Make sure overhead light is off. Exposure to light could ruin blue print paper.

(2) Blue print paper is located in drawer beneath machine. Place original drawing (right side up) over yellow side of blue print paper.

(3) Turn machine on.

(4) Press and hold down until the light under the roller turns purple. Release.

(5) Set this control depending upon how dark your original draft is. If your draft is light, then you will need to set the control towards dark. You may need to try this more than once with different settings until you get a good copy.

(6) Place your alligned draft and blue print paper on the shelf as illustrated. Gently push in until roller grabs.

(7) Both papers will come out over the roller. Do not pull on them.

(8) Your original will be on the bottom. Take this and place on top of machine while rolling the blue print paper over and insert on second shelf.

(9) Your copy will come out here.

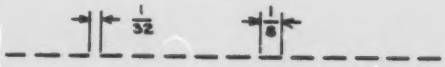
(10) Turn machine off.

DO NOT TOUCH AMMONIA FLOW CONTROL OR FORWARD-REVERSE BUTTON.
IF YOU HAVE PROBLEMS, CONSULT YOUR INSTRUCTOR.

LINE GUIDE

THIN LINES

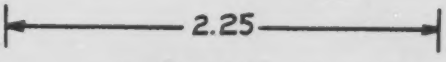
Hidden line



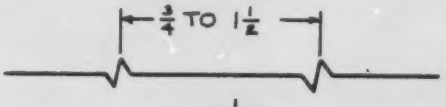
Section line

Center line

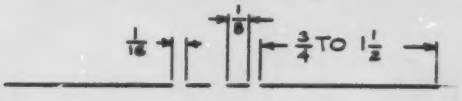
Dimension line
Extension line
and Leaders



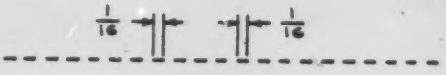
Long-break line



Phantom line

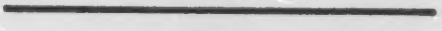


Stitch line

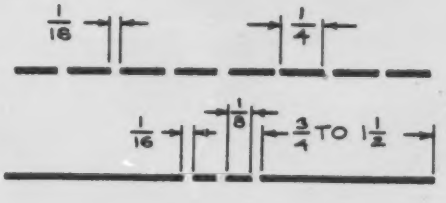


THICK LINES

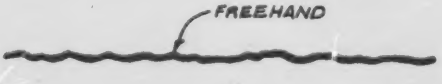
Visible line



Cutting-plane
or
Viewing-plane
Lines



Short-break line

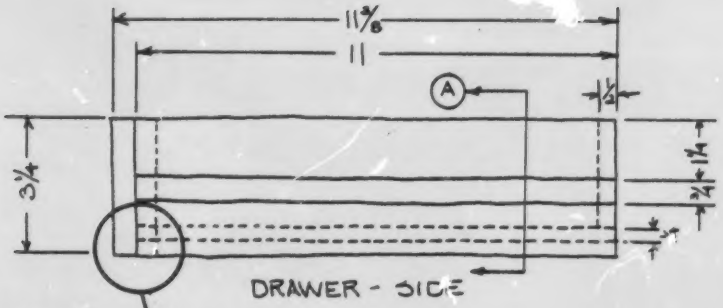


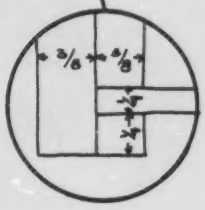
ABCDEFGHIJKLMN
OPQRSTUVWXYZ 123456789

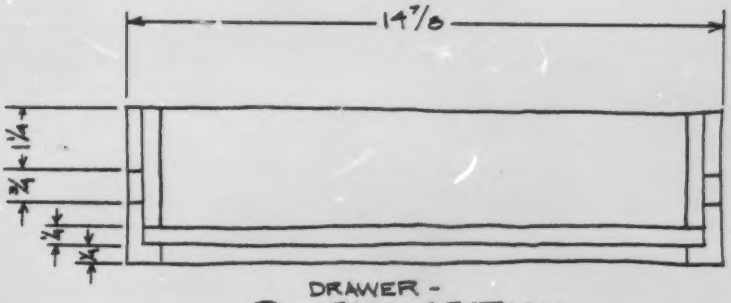
DRAFTING PROJECT

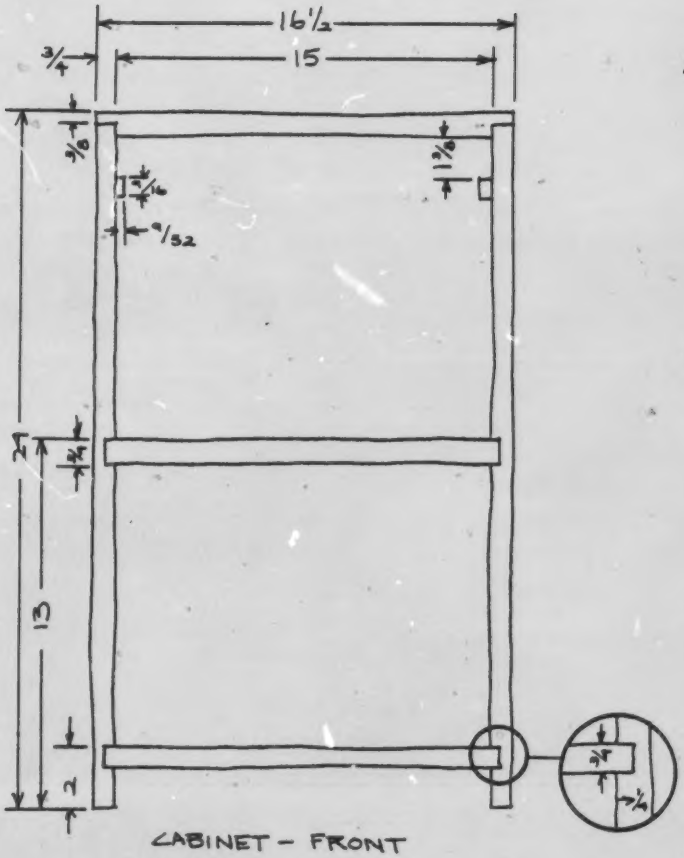
NIGHTSTAND

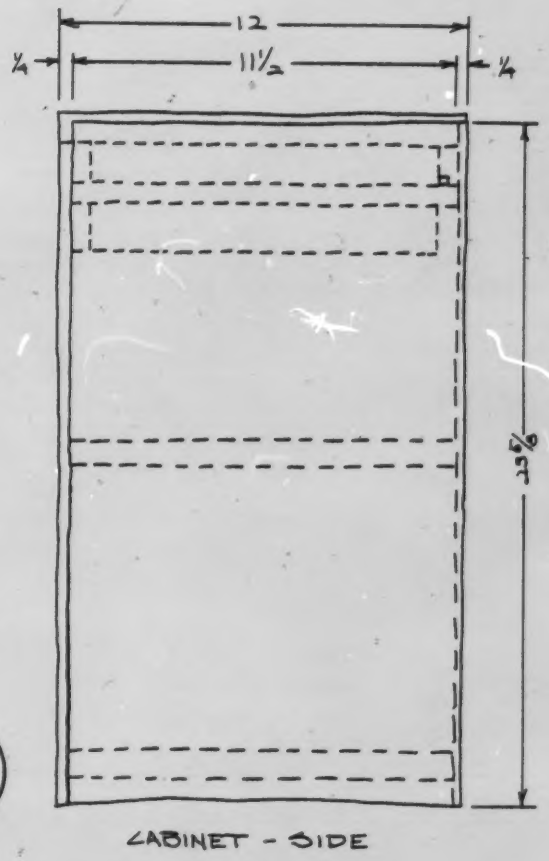
(not to scale)











MECHANICS

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LUBRICATION SYSTEM	12
STEERING	13

INTRODUCTION

In the mechanics module we will become familiar with mechanics' terminology, tools, and work environments as well as the basic system in an automobile. We will also learn some basic automobile maintenance procedures that you can do on your own car. We hope the experience in class will take the mystery away from working on automobiles and that you will learn to use repair manuals as tools for trying different kinds of mechanical maintenance procedures.

Although we will focus on automobile mechanics, you should become aware of the many other types of mechanics occupations. Mechanics work in many different types of jobs and with many different types of equipment, but the basic concepts and tools are similar.

RELATED JOBS

AIR CONDITIONING, REFRIGERATION & HEATING MECHANIC

APPLIANCE REPAIR

BOAT ENGINE REPAIR

BUSINESS MACHINE REPAIR

DIESEL MECHANIC

FARM EQUIPMENT REPAIR

GAS STATION ATTENDANT

INDUSTRIAL MACHINERY REPAIR

INSTRUMENT REPAIR

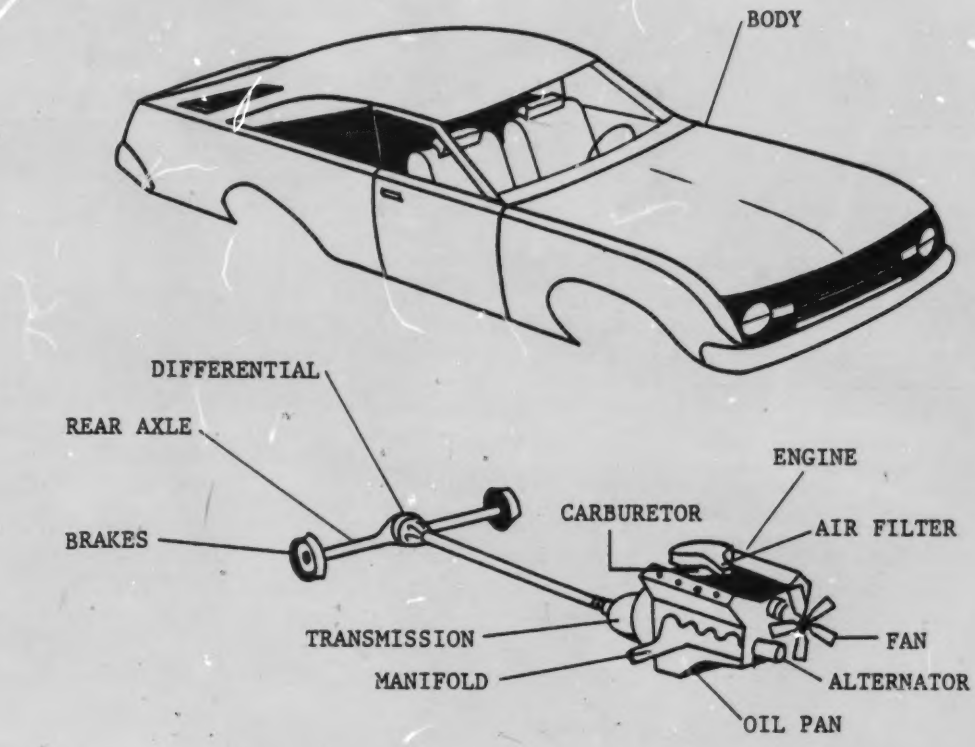
MAINTENANCE ELECTRICIAN

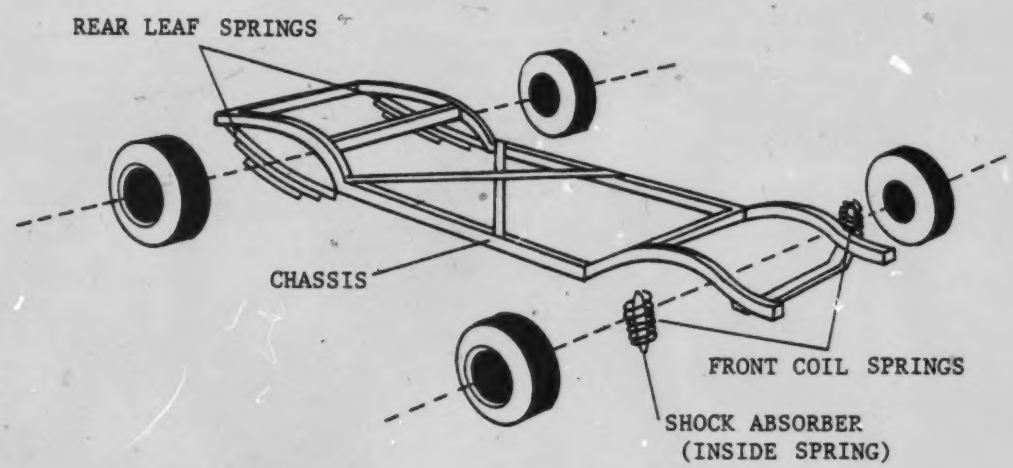
MOTORCYCLE MECHANIC

PARTS

TRUCK AND BUS MECHANIC

VENDING MACHINE MECHANIC


BODY
DIFFERENTIAL
REAR AXLE
BRAKES
ENGINE
CARBURETOR
AIR FILTER
TRANSMISSION
FAN
MANIFOLD
ALTERNATOR
OIL PAN


REAR LEAF SPRINGS
CHASSIS
FRONT COIL SPRINGS
SHOCK ABSORBER
(INSIDE SPRING)

MECHANICS

Although an automobile has thousands of parts, these are the major working systems that will be discussed in this module:

Cooling System

Electrical and Ignition System

Fuel System

Engine

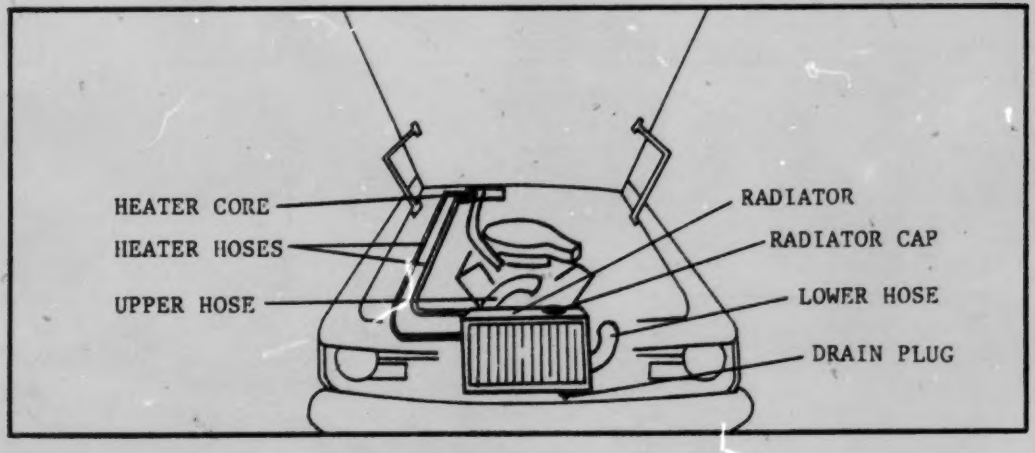
Transmission and Differential

Wheels and Brakes

Lubrication System

Steering

NOTE: The explanations provided do not cover all the various systems found in cars, only the most common.



COOLING SYSTEM

The cooling system includes the RADIATOR, THERMOSTAT, HOSES, FAN and FAN BELT, WATER PUMP, COOLANT and HEATER. The coolant (usually a mixture of water and antifreeze) is circulated by the water pump to pick up heat from the engine.

The coolant is pumped through openings in the engine block, through the upper hose, and back to the radiator. The flow of the coolant back to the radiator is regulated by the thermostat, which is located in the engine block at the opening to the upper hose. The location of the thermostat varies. The fan blades in front of the radiator drive air over the radiator to remove heat from the coolant. The fan belt which drives the fan also drives the water pump. The cooling system is also the source for heating a car as the heater hoses carry the heated coolant to the heater core and back to the radiator. FIG. 1 shows how the engine water jacket allows coolant to surround the cylinder and where the head gasket forms a tight seal to keep the coolant out of the combustion chamber.

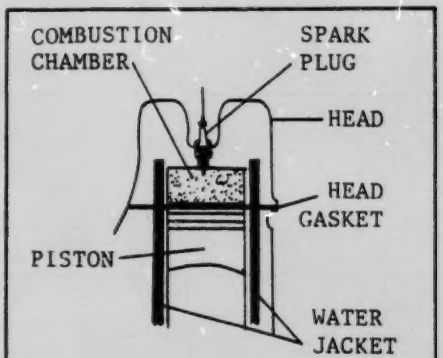
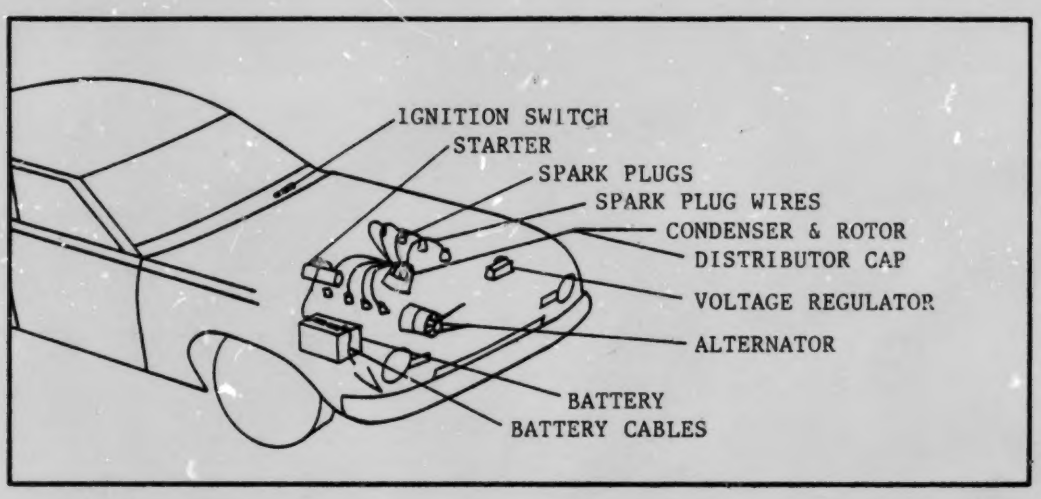


Fig. 1

ELECTRICAL AND IGNITION SYSTEM

The electrical system includes the BATTERY, ALTERNATOR, STARTER MOTOR, and all electrical accessories. The starter motor is exactly what the name implies--a motor which starts the engine. The electrical current needed to start the engine and power the accessories is stored in the battery. To keep the battery charged, an alternator is needed. The alternator uses power from the engine to create electrical energy that recharges the battery. A VOLTAGE REGULATOR controls the voltage sent to the battery and other electrical components.



When the car is started, current flows from the battery to the COIL which is part of the ignition system. The coil boosts the voltage from the battery to around 25,000 volts (the voltage is necessary to burn the fuel and air mixture in the cylinders). The DISTRIBUTOR sends the electrical charge to the SPARK PLUG in each cylinder. When the current jumps the gap (FIG. 2) at the end of the spark plug, it begins combustion of the fuel/air mixture in the cylinder. The ROTOR and CAP are part of the distributor. The rotary rotates inside the cap distributing current to the spark plugs in the proper sequence called the FIRING ORDER (FIG. 3). Each spark plug fires in sequence as its cylinder approaches the end of the compression stroke. (This will be explained in part 4--ENGINE.) Firing order varies with the number and arrangement of the

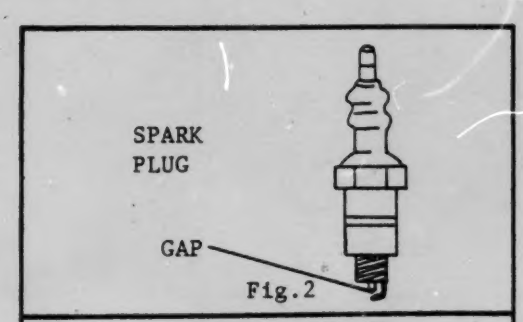


Fig.2

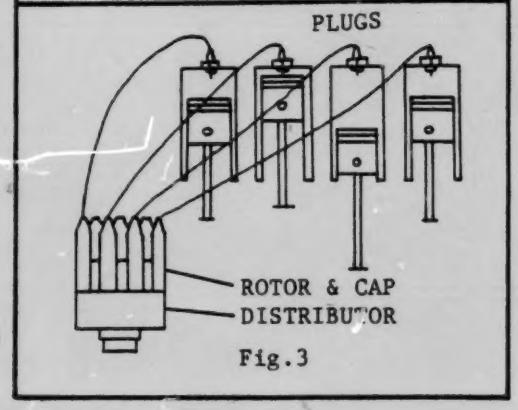


Fig.3

cylinders. Most autos have a cycle of four strokes, constantly repeated. A stroke is the movement of the piston all the way up or all the way down inside the cylinder. Lawn mowers and chain saws usually have a two stroke engine. In the two stroke engine, the engine fires every second stroke of the piston instead of every fourth stroke.

IGNITION TIMING is important for proper fuel burning. Spark plugs fire before, after, or as the piston reaches the top of the cylinder, depending on the system. Since the piston moves up and down faster as the engine speeds up, the ignition must be timed with the crankshaft rotation (FIG. 4). A timing light is used to set the timing (FIG. 5) during tune-up. The correct timing is indicated when the timing light (which flashes light at even intervals) makes the timing marks visible and shows them properly lined up.

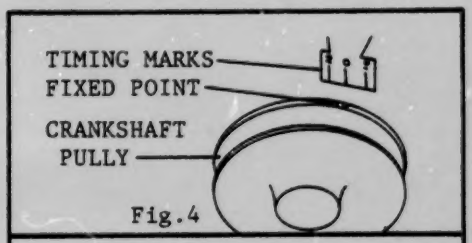


Fig.4

Fig.5

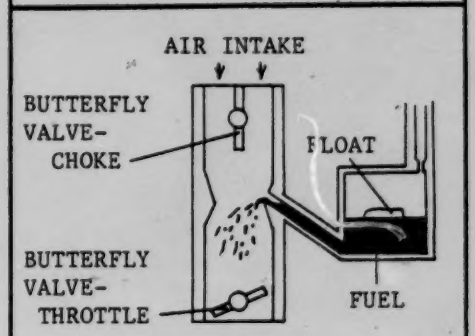
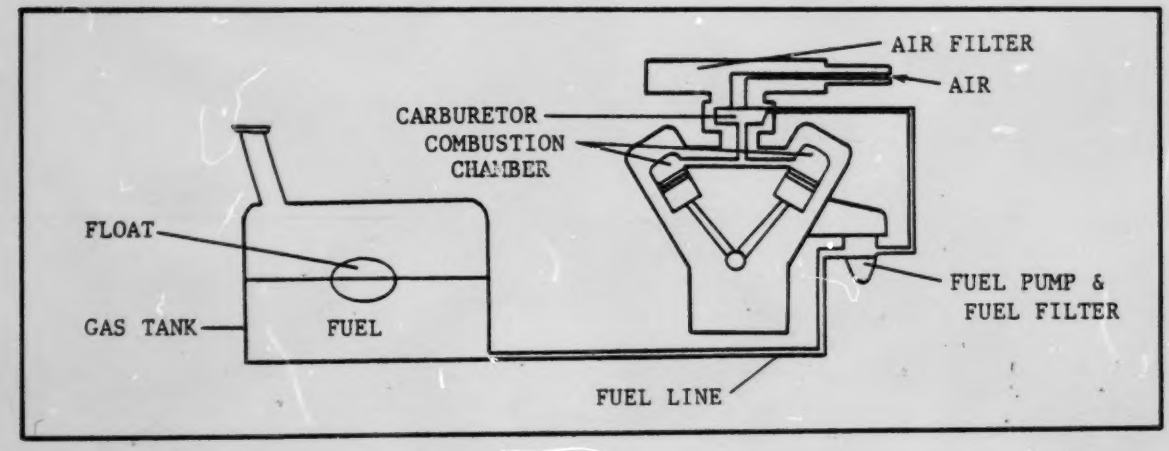


Fig.6

FUEL SYSTEM

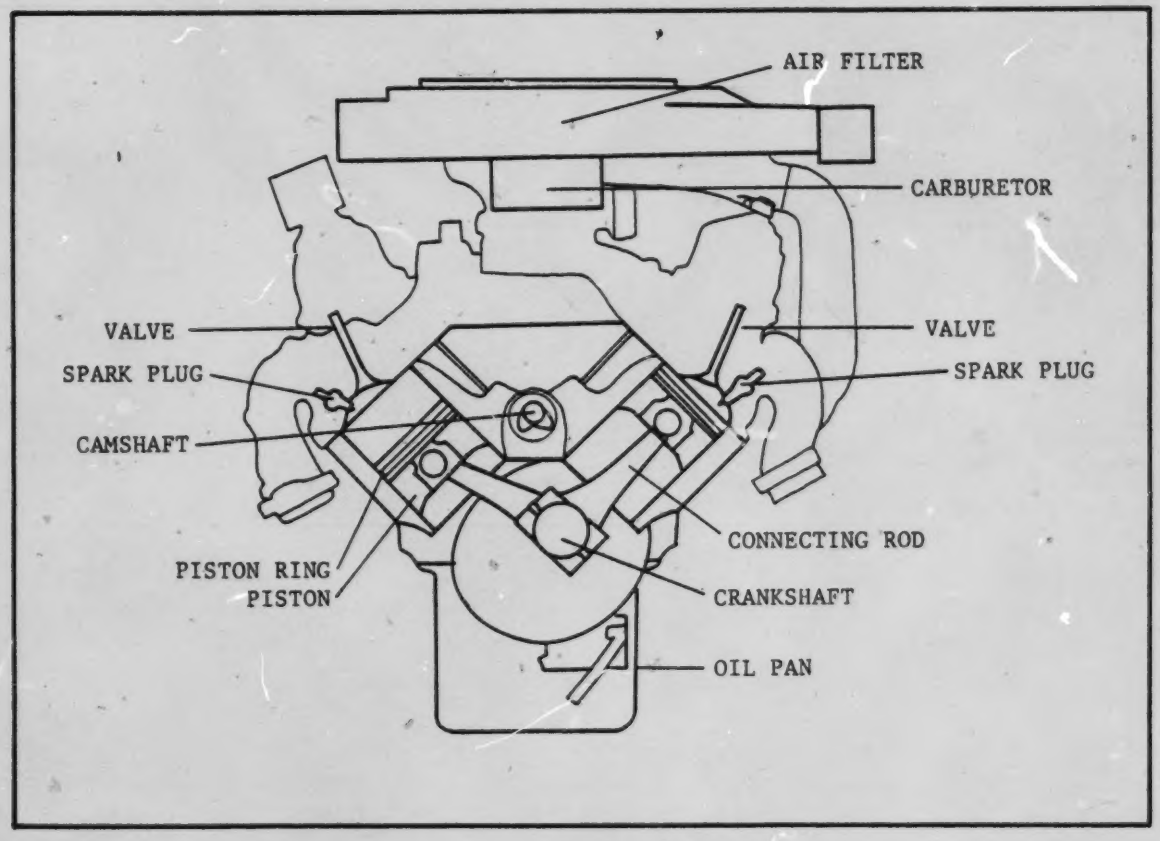
The fuel system's major parts are the FUEL PUMP and FUEL FILTER, AIR FILTER, and CARBURETOR. The fuel pump sends a steady supply of gas for combustion through the fuel line to the carburetor. Air is pulled in through the air filter by the vacuum created by action of the pistons moving down in the

cylinders. The air filter keeps dirt and dust out of the carburetor which mixes and controls the air/fuel ratio. The amount of this fuel mixture going into the cylinders controls the speed of the car. A BUTTERFLY VALVE - THROTTLE (FIG. 6) is operated by the gas pedal to control the amount of air entering the carburetor. Increasing the air/fuel mixture means more acceleration.

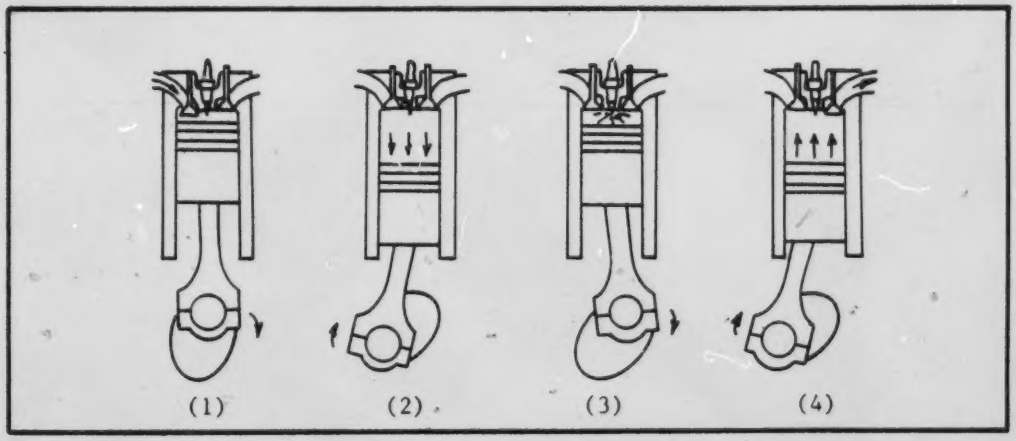


ENGINE

The electrical and fuel systems that have just been explained provide the current, fuel, and air necessary for engine operation. The most common internal combustion engine is the four-stroke engine powered by gasoline. Below is a diagram of its most important parts.



Inside the cylinders of the engine are pistons which are connected to the CRANKSHAFT and are tight fitting because of the piston rings. In a four cylinder engine, the crankshaft makes the pistons in cylinders 1 & 3 go down while the pistons in cylinders 2 & 4 go up. When the proper fuel mix is fed into the cylinder and the sparks from the spark plugs are in proper firing order, the sparks ignite the fuel and the resulting pressure forces the pistons down. The crankshaft then turns, forcing the pistons upward to receive another spark plug firing. Four strokes complete each piston cycle.



1. Intake stroke--piston goes down, sucking in air/fuel mix from carburetor.
2. Compression stroke--the air/fuel mix is compressed and heated by upward movement of the piston; the air/fuel mix is ignited by spark from spark plug.
3. Power stroke--igniting of the air/fuel mix creates a great force that drives the piston down.
4. Exhaust stroke--piston moves upward and burned fuel in the cylinders is forced out through exhaust valve.

Each cylinder has INTAKE and EXHAUST VALVES to control the entry of the air/fuel mix and the exit of the exhaust. Valves are operated by LIFTERS and PUSH RODS attached to the CAMSHAFT. When the piston goes down on the intake stroke, the intake valve is open allowing the air/fuel mix into the cylinder. Both valves are closed on the compression and power strokes. When the piston moves up during the exhaust stroke, the exhaust valve is open. The pistons are connected to the crankshaft by CONNECTING RODS. The up and down movement of the pistons is turned into rotary motion in the crankshaft. The crankshaft turns and sends power through to the rest of the system.

The engine has two MANIFOLDS--intake and exhaust (FIG. 7). The air/fuel mix from the carburetor enters the cylinders through the intake manifold and burned gases exit from the cylinders through the exhaust manifold that is connected to the exhaust pipe and the muffler.

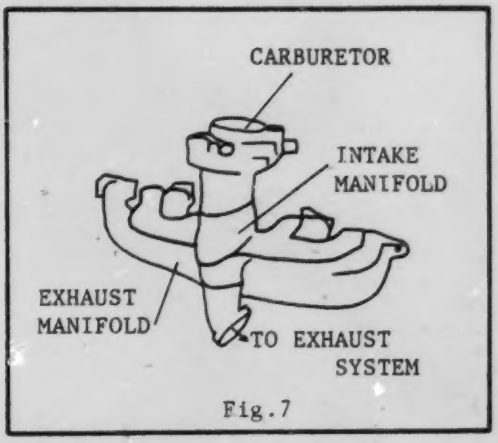


Fig.7

TRANSMISSION AND DIFFERENTIAL

The TRANSMISSION increases the torque (the amount of turning force produced) available to turn the wheels. Cars need a DRIVELINE to carry the transmissions power to the rear wheels. The driveline also has joints called universal or U-joints which allow for up and down movement as the car goes over road bumps. The DIFFERENTIAL is a set of gears that transfers power from the driveline to the rear axle. The differential gears let the wheels turn together or turn at different speeds. This allows the car to turn corners, where the outside wheel will have to turn faster.

The transmission consists of gears which engage or disengage in order to provide power for the desired speed. First gear overcomes neutral to get the car moving. Since low rpm (engine revolutions per minute) means low torque (power), the transmission is necessary to increase torque. The gears in the transmission change torque as needed. In low gear the transmission has a gear ratio of 3:1, which means that one gear turns three times to one of the other gear. When the large gear turns, the torque of the smaller gear is increased (FIG. 8). In second gear, the gear ratio is 2:1. In drive the gear ratio is 1:1, which means gears are equal size (FIG. 9).

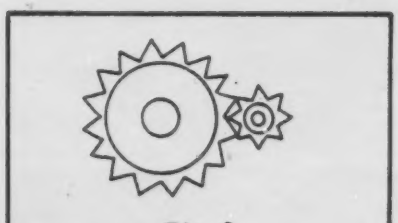
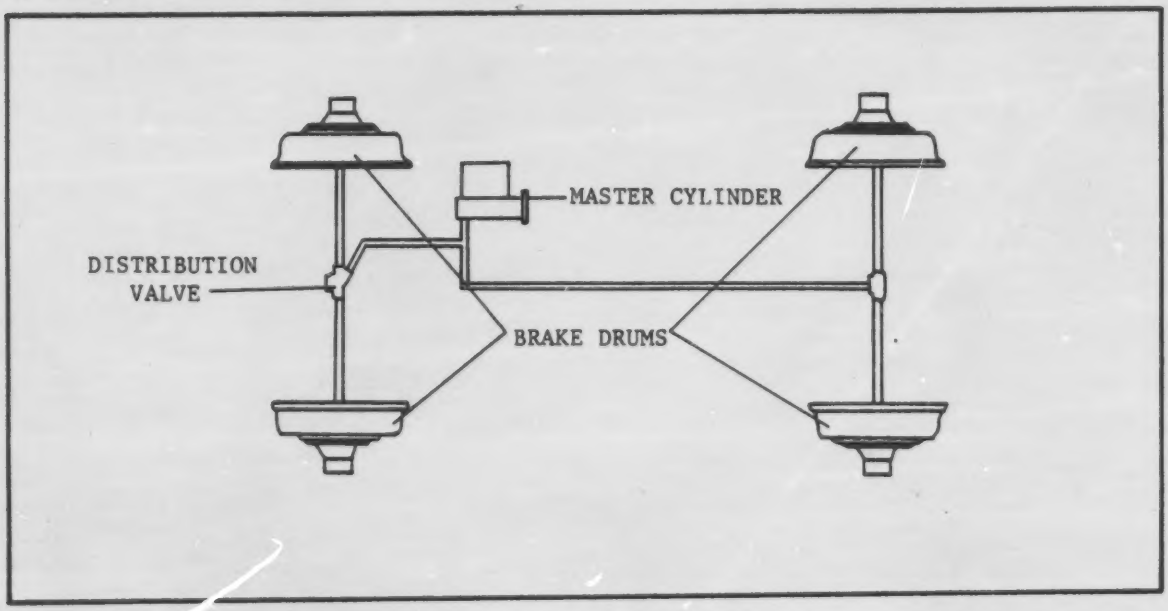


Fig.8

Fig.9

WHEELS AND BRAKES

Mechanical force supplied by pushing on the brake pedal provides the pressure that is applied to the brakes on the wheels. This force is multiplied by the hydraulic force of the brake fluid.



The MASTER CYLINDER is a reservoir of brake fluid--some contain two sections, one for the front and one for the rear wheels. It also converts mechanical pressure to hydraulic pressure. Pushing a brake pedal creates the hydraulic pressure from the master cylinder and transfers it through the brake line to the WHEEL CYLINDERS at each brake (FIG. 10). Wheel cylinders have pistons which move the BRAKE SHOE against the moving BRAKE DRUM, creating friction which stops the rotation of the wheel (FIG. 11).

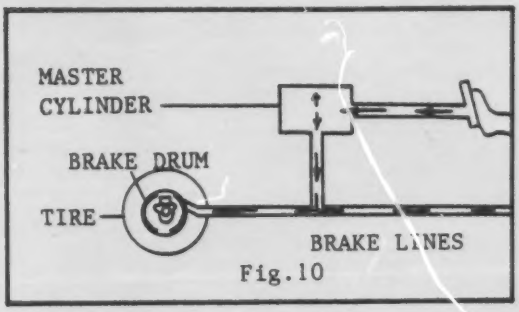


Fig.10

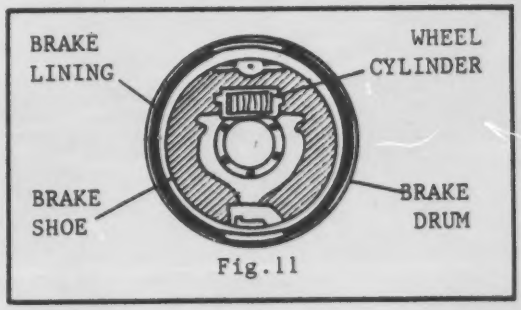
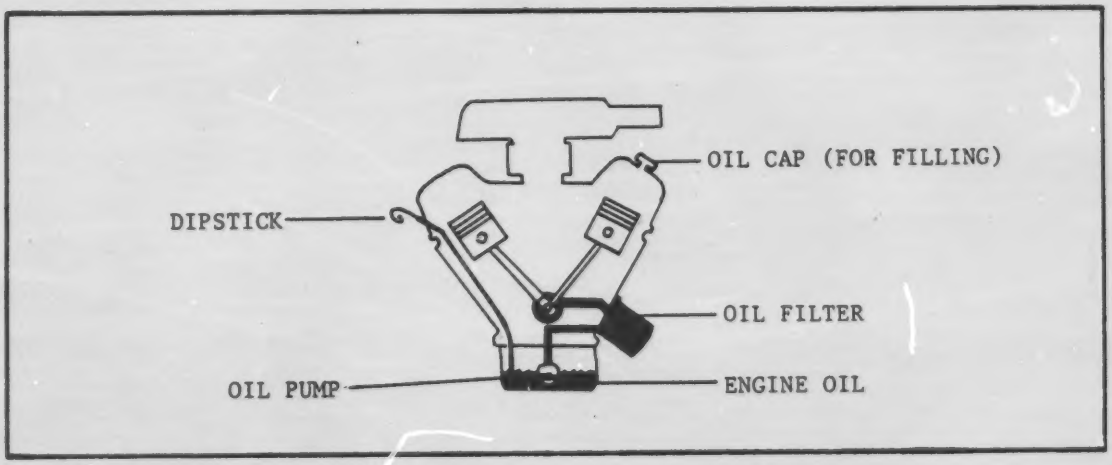


Fig.11

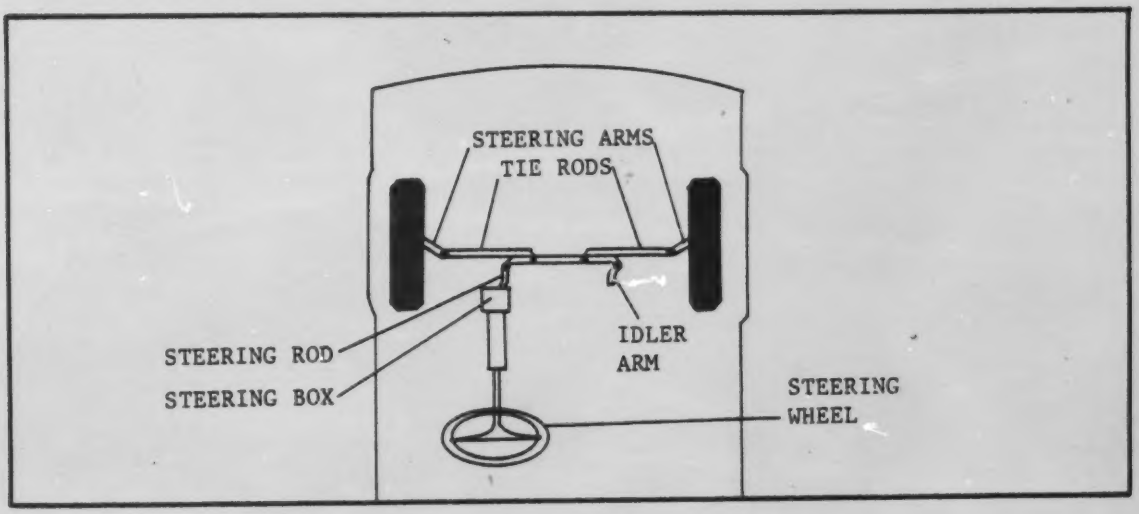
LUBRICATION

The engine is made up of metal parts which move against each other. Oil is necessary to lubricate these parts so that they do not wear out or seize up because of excessive heat. The crankcase, which houses the crankshaft, has a reservoir for oil called the OIL PAN. An OIL PUMP circulates the oil and the OIL FILTER keeps it clean.



STEERING

When the steering wheel is turned, the movement is multiplied by the gears within the STEERING BOX. The STEERING LINKAGE, which connects the gear box to the front wheels, moves the wheels in the direction the steering wheel turns. The linkage consists of round TIE RODS connected by sockets called the TIE ROD ENDS. The RELAY ROD transfers the direction from the steering box to the tie rods and then to the lower steering arms of the wheels.



CONSTRUCTION

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BUILDING TERMS	2
FOUNDATION WALLS	3
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FRAMING DETAILS	5
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INTRODUCTION

The Construction module of Industrial Orientation will introduce you to the basic concepts, terminology, tools, materials, and methods used in wood frame construction. You will also be introduced to energy effecient construction and passive solar design.

Training in construction can prepare you for construction jobs, related jobs such as sales, estimating, materials handling, or remeodeling/restoration work. It can also prepare you for apprenticeships in carpentry and related construction occupations.

RELATED JOBS

ARCHITECTS

BUILDING INSPECTORS

CARPENTERS

BRICKLAYERS

MASONS

FLOOR LAYERS

GLAZIERS

PLASTERERS & DRYWALL INSTALLERS

PLUMBERS

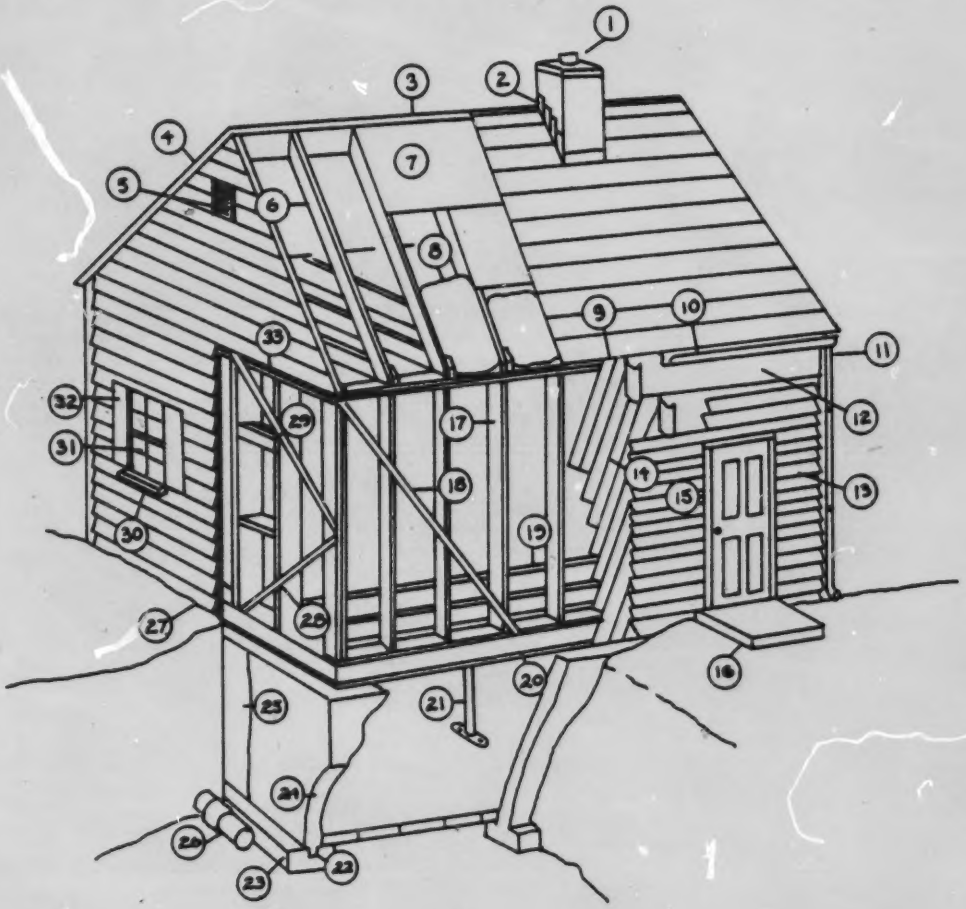
ROOFERS

CONSTRUCTION SUPERINTENDENTS

REMODELING & RESTORATION

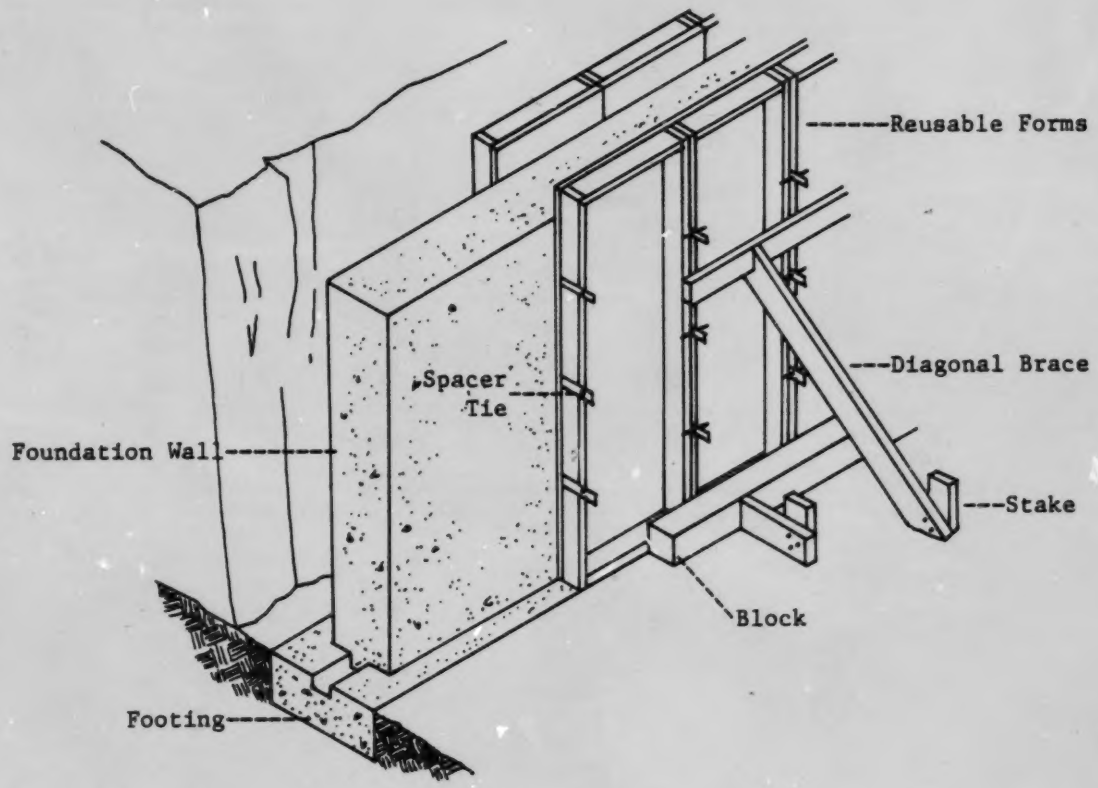
MATERIALS SALES

BUILDING TERMS

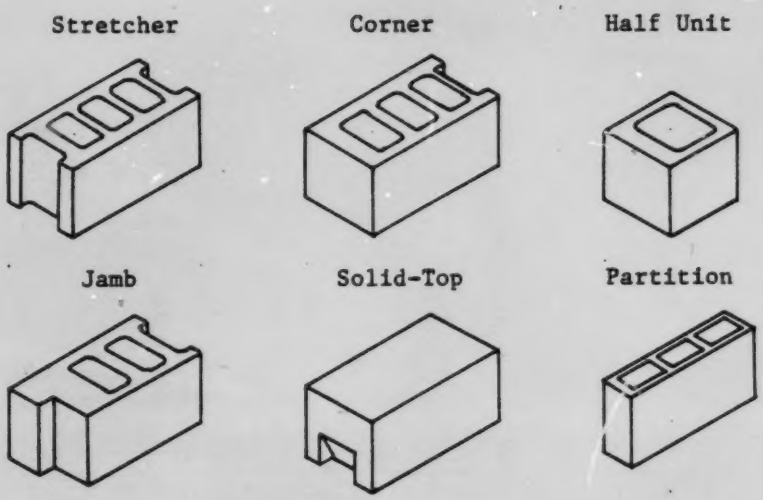


(1) Chimney flue
(2) Flashing
(3) Ridge
(4) Rake
(5) Vent; Louver
(6) Rafter
(7) Roof decking
(8) Insulation
(9) Gutter
(10) Eave
(11) Downspout
(12) Building paper
(13) Bevel Siding
(14) Wall Sheathing
(15) Trim
(16) Stoop
(17) Stud
(18) Corner Brace
(19) Floor Joist
(20) Sill Plate
(21) Steel Column
(22) Keyway
(23) Footing
(24) Foundation Wall
(25) Waterproofing
(26) Drain Tile
(27) Grade Line
(28) Knee Brace
(29) Lintel; Header
(30) Sill
(31) Double Hung Window
(32) Shutters
(33) Double Plate

FOUNDATION WALLS

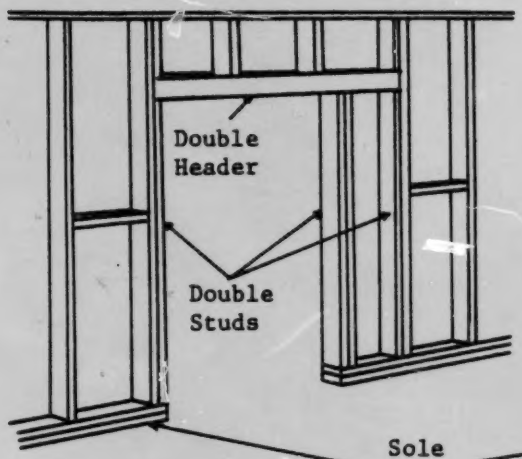


CONCRETE BLOCKS

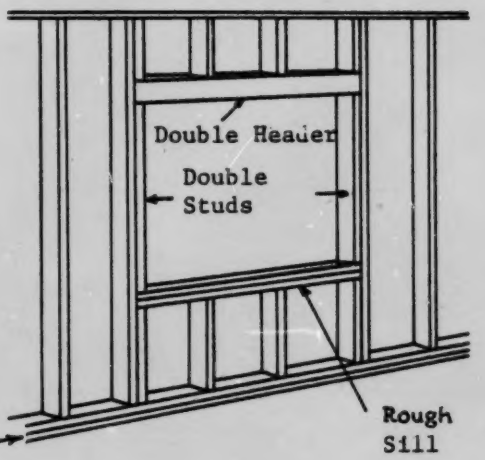


FRAMING

DOOR

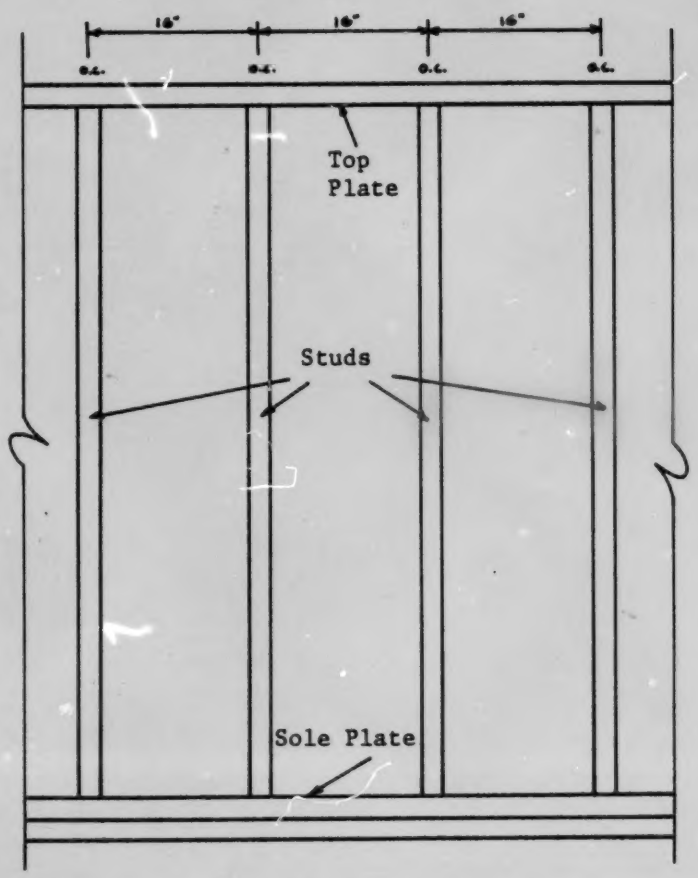


WINDOW



Sole
Plate

STUD SPACING

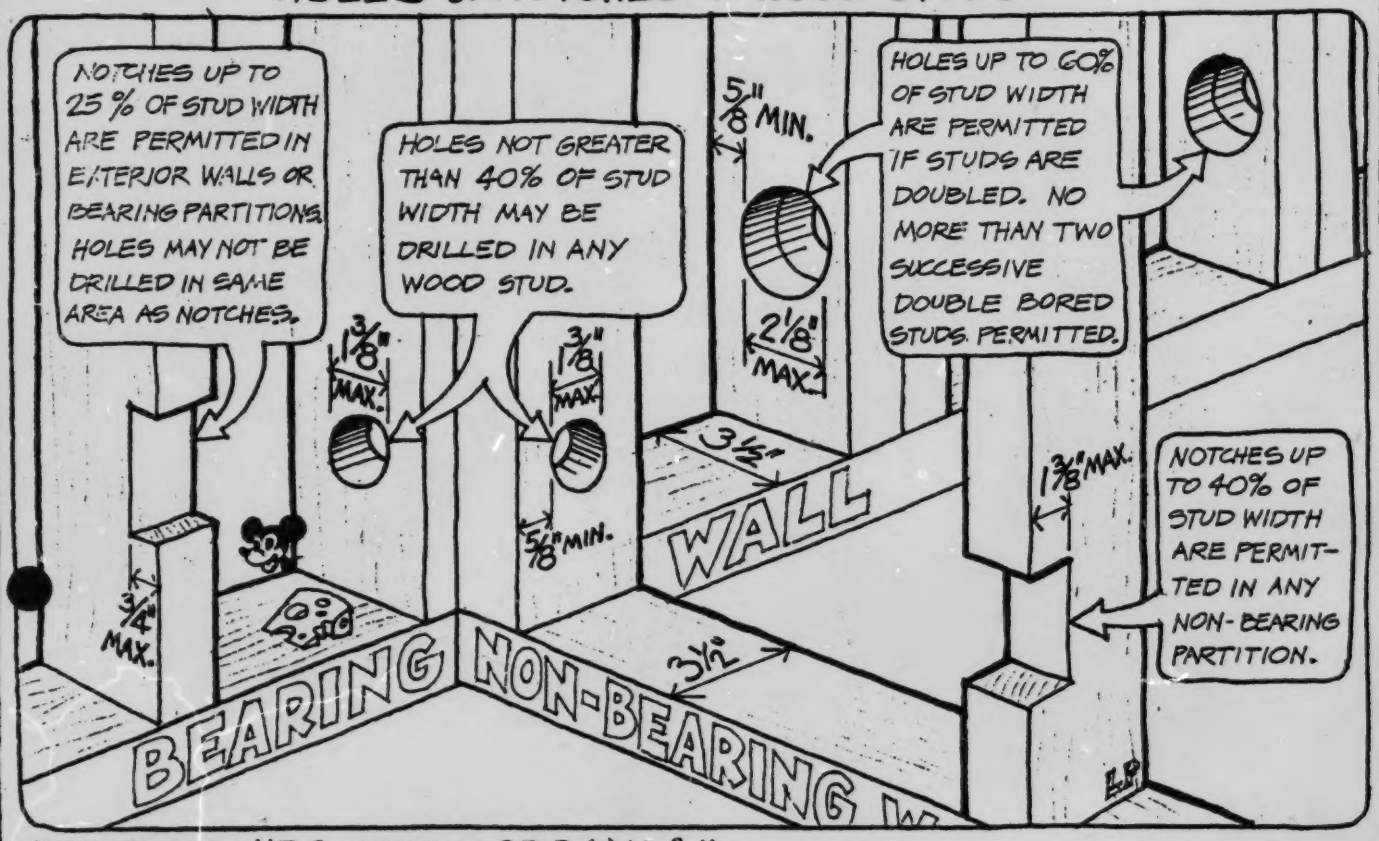


CITY OF EUGENE DEPARTMENT OF PUBLIC WORKS BUILDING DIVISION 3/1/78

WOOD FRAMING DETAILS

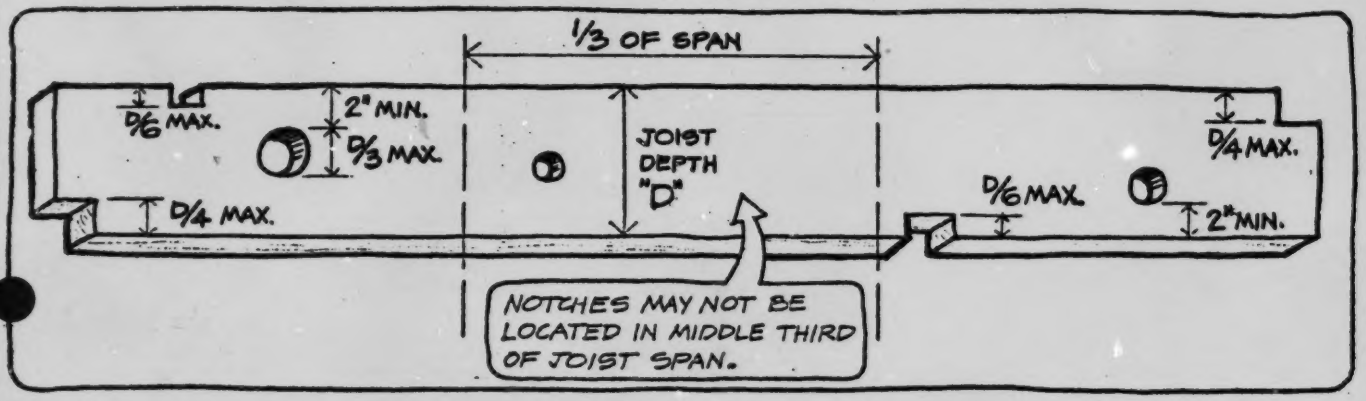
ILLUSTRATING SOME PROVISIONS OF U.B.C. CHAPTER 25

HOLES & NOTCHES IN WOOD STUDS

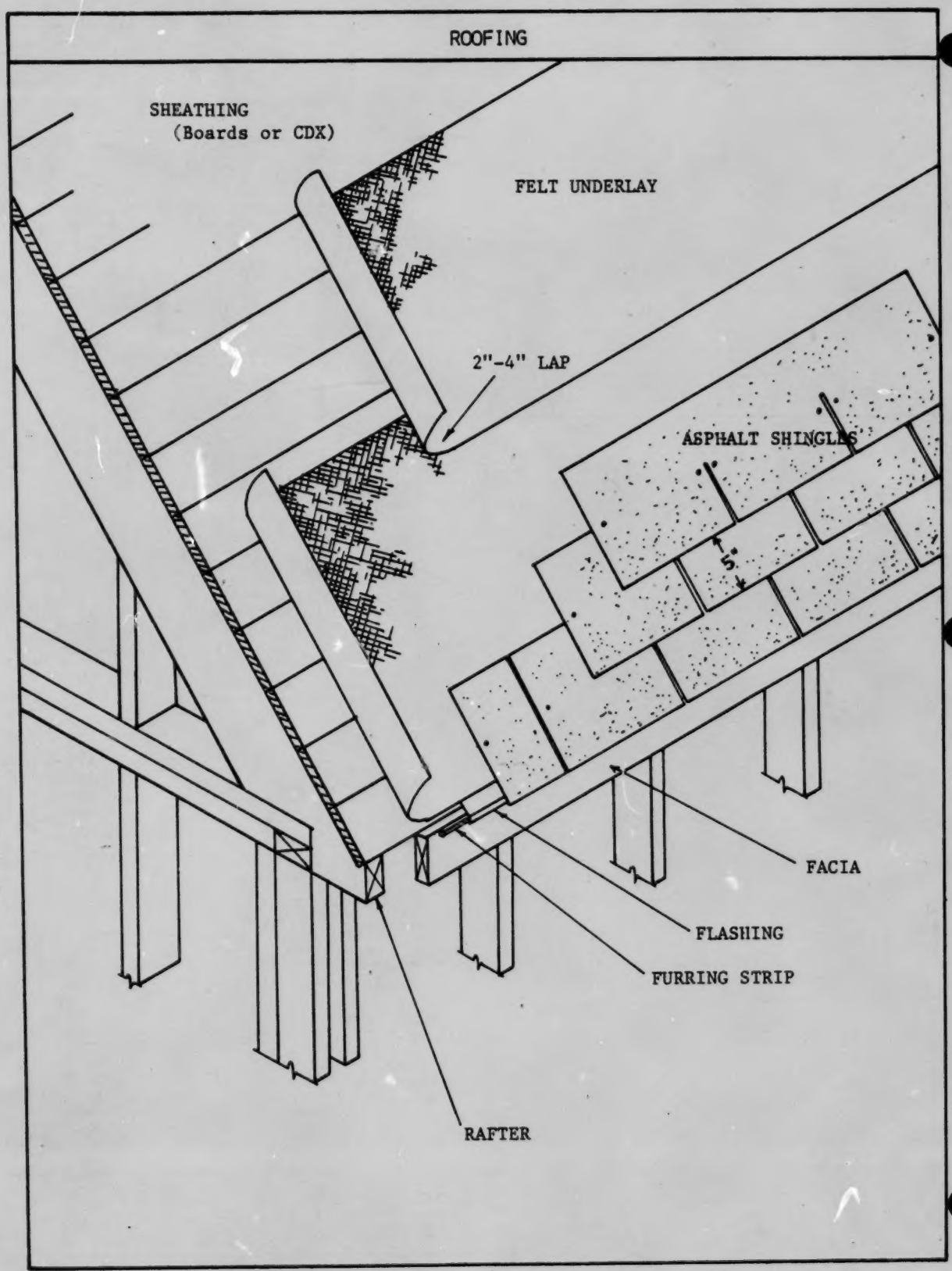

NOTCHES UP TO 25% OF STUD WIDTH ARE PERMITTED IN EXTERIOR WALLS OR BEARING PARTITIONS. HOLES MAY NOT BE DRILLED IN SAME AREA AS NOTCHES.
HOLES NOT GREATER THAN 40% OF STUD WIDTH MAY BE DRILLED IN ANY WOOD STUD.
5/8" MIN.
HOLES UP TO 60% OF STUD WIDTH ARE PERMITTED IF STUDS ARE DOUBLED. NO MORE THAN TWO SUCCESSIVE DOUBLE BORED STUDS PERMITTED.
1 3/8" MAX.
3/4" MAX.
2 1/8" MAX.
3 1/2"
WALL
1 3/8" MAX.
NOTCHES UP TO 40% OF STUD WIDTH ARE PERMITTED IN ANY NON-BEARING PARTITION.
BEARING
NON-BEARING

REFERENCE: UBC SECTION 2518(g) 10 & 11.
NOTE: DIMENSIONS SHOWN APPLY TO 2X4 FRAMING. OTHER SIZES VARY ACCORDINGLY.

HOLES & NOTCHES IN WOOD JOISTS



REFERENCE: UBC SECTION 2518(d)3

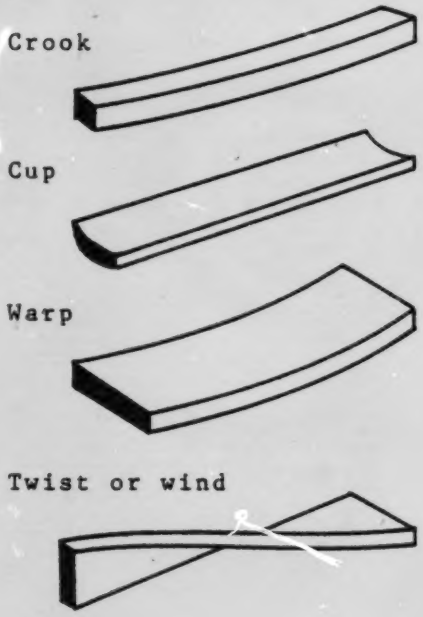

ROOFING
SHEATHING
(Boards or CDX)
FELT UNDERLAY
2"-4" LAP
ASPHALT SHINGLES
5"
FACIA
FLASHING
FURRING STRIP
RAFTER

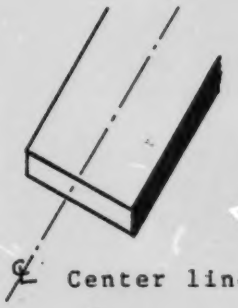
6

WOODWORKING TERMINOLOGY

Split or check

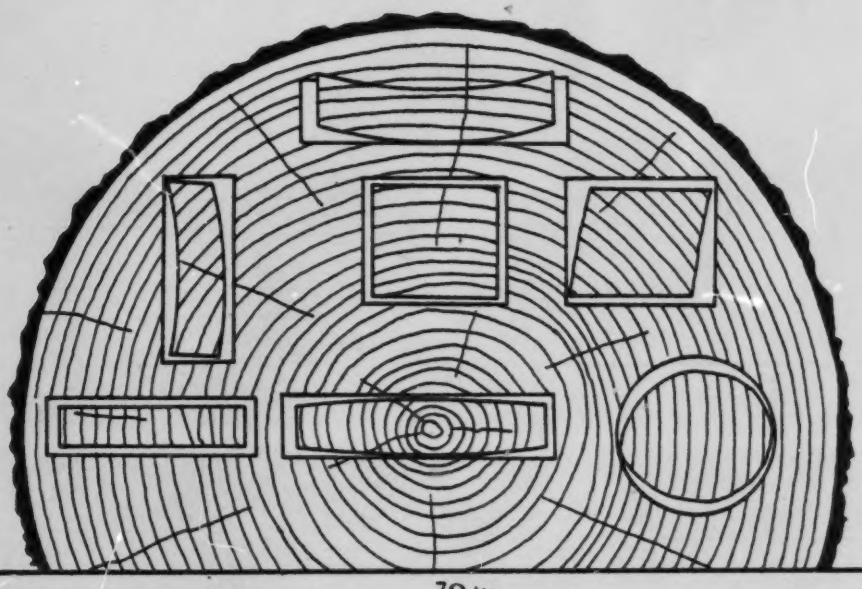
Shake





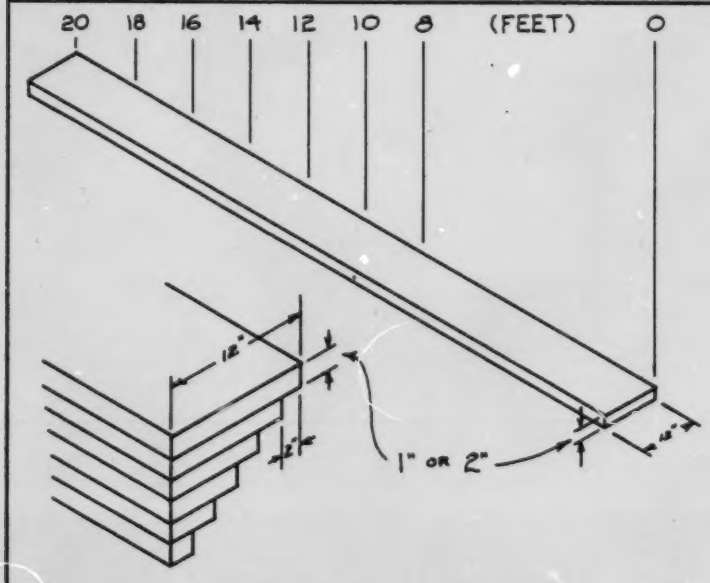
Edge distance

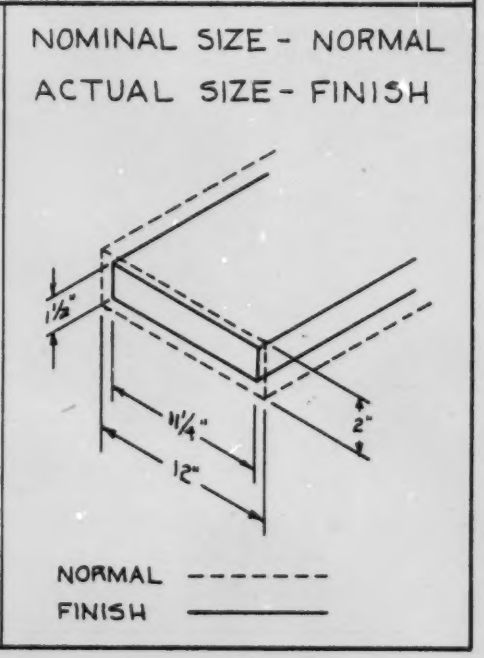
TYPICAL SHRINKAGE AND DISTORTION OF WOOD FROM LOGS



LUMBER GRADES FOR SOFTWOODS		
Classification	Grade	Description
Select	A	Nearly flawless-best choice for stains & natural finishes
	B	Same as "A" but may contain small defects
	C	Defects which can be hidden by paint
	D	Same as "C" but more defects
Common	#1	Contains some defects but should not have warps, splits, or decay- good utility lumber
	#2	Fairly sound- no splits or warps- may have loose knots or discoloration
	#3	Medium quality- any type of defect may be found
	#4	Low quality- all defects plus open knot holes
	#5	Poorest quality- used as filler
Structural (Graded mainly for strength)	Construction	Highest quality
	Standard	High quality with slight defects
	Utility	Poor quality- used when strengthened by additional members
	Economy	Lowest quality

STOCK SIZES





SAWING TERMS

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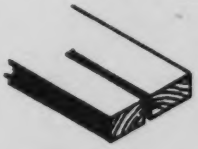
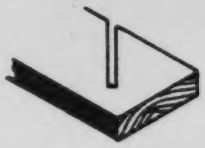
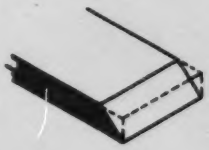


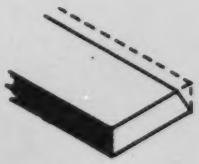
Ripcut



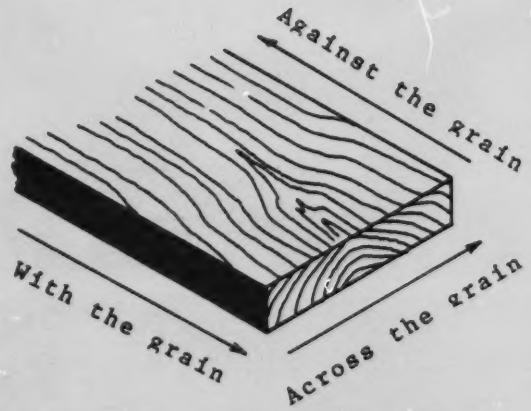
Miter



Cross miter

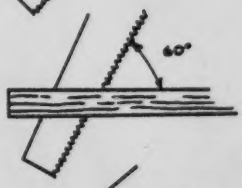


Bevel

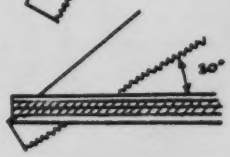


SAWING TIPS

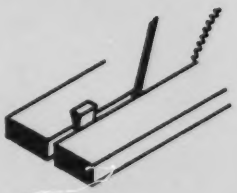
Crosscut Angle



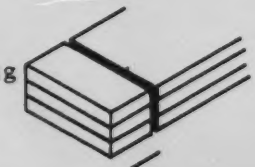
Ripcut Angle



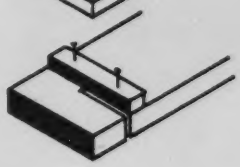
Plywood Angle



Use chip to hold kerf open

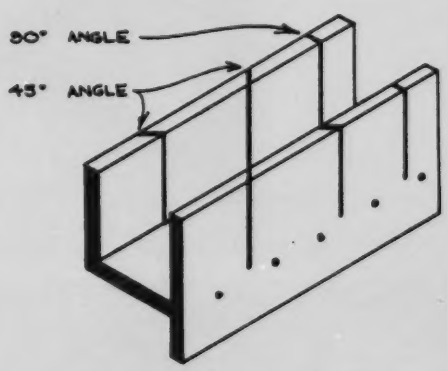


Stack for cutting duplicates

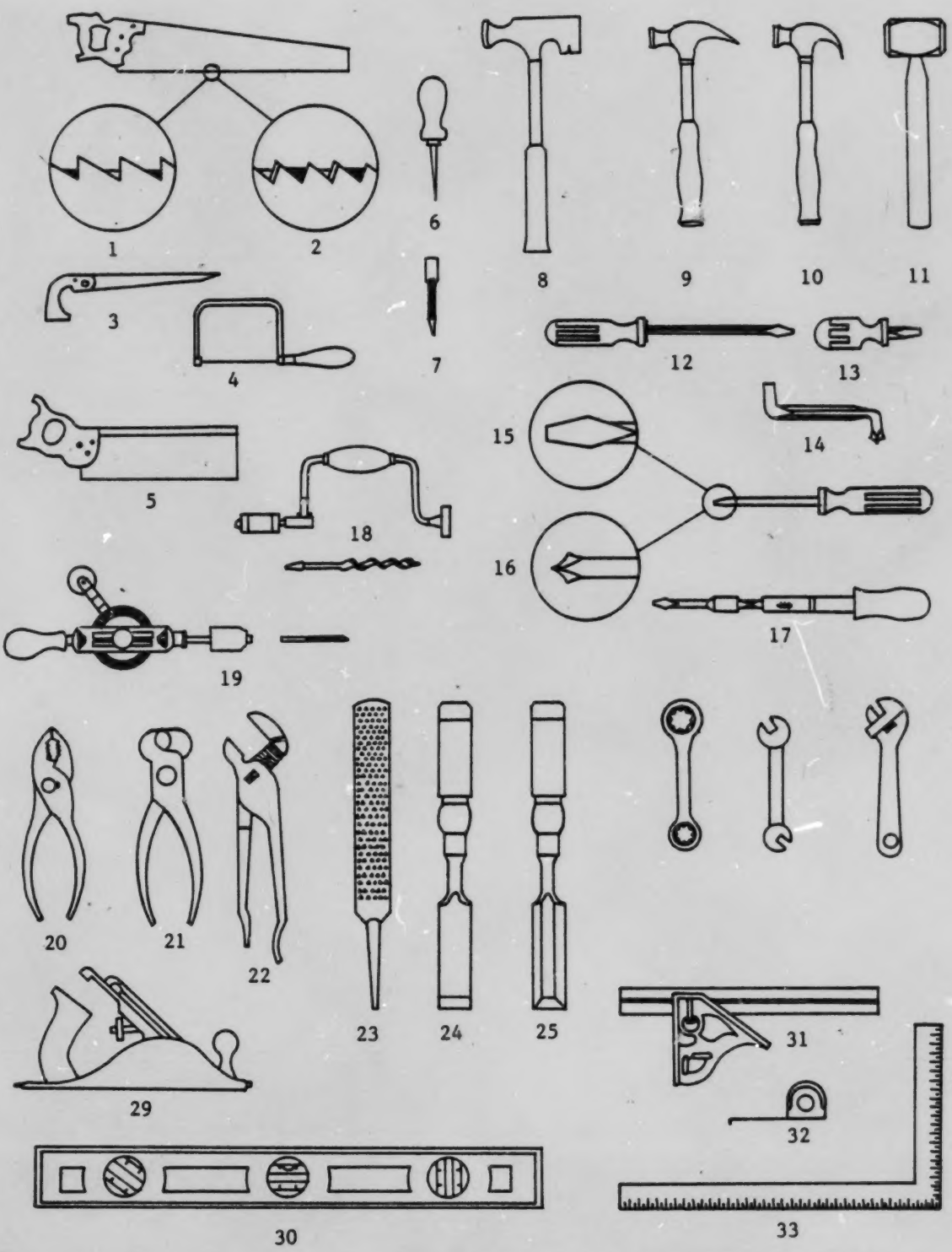


Tacked for clamped guide for saw

MITER BOX



HAND TOOLS



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HAND TOOL DESCRIPTIONS

1) Rip Saw	26 inch blade with 5 1/2 teeth per inch; Use for cutting with the grain; to start a ripping cut, use the tip portion of the blade.
2) Crosscut Saw	26 inch blade with 7 to 12 teeth per inch; Use for cutting across the grain, miter cuts and plywood; To start a crosscut, use the butt portion of the blade near the handle.
3) Compass Saw	12 or 14 inch; Use for cutting curves or inside cuts; Start cutting from a hole bored in the wood.
4) Coping Saw	Blades are 1/16" to 1/8" wide and from 6" to 6 5/8" long; Blades can face in any direction; Use for cutting small-diameter curves.
5) Backsaw	10 to 16 inch in length with 12 or 13 teeth per inch; Use for smooth cuts or joint cutting.
6) Scratch Awl	Starting holes for small screws; Marking dimension points.
7) Nail Set	Use to drive nails below wood surface so that they may be hidden with wood putty.
8) Drywall Hammer	Lightweight hammer for driving nails into drywall with slot for pulling nails.
9) Hammer W/ Ripping Claw	20 to 22 oz.; Heavy-duty hammer for driving large nails or spikes and separating nailed boards.
10) Claw Hammer	16 oz.; General carpentry work.
11) Sledge Hammer	2 to 20 lbs.; Heavy work such as driving large stakes.
12) Square Blade Screwdriver	Use for hard-to-turn screws; Equipped to take wrench.
13) Stubby Screwdriver	Use for tight spots.
14) Offset Screwdriver	Use for awkward spots.
15) Standard Screwdriver	Use for slotted head screws or drivescrews.
16) Phillips Screwdriver	Use for Phillips head screws.
17) Spiral Ratchet Screwdriver	Use to drive a number of screws rapidly; Can be set in reverse to remove screws.

18) Brace & Bit	Use to bore holes for bolts or dowels; Many types of bits are available.
19) Hand Drill & Points	Use to drill small holes such as holes to start screws.
20) Slip-joint Pliers	Use for gripping various materials; Adjusts for normal or wide opening.
21) End-cutting Nippers	Hardened cutting edge for cutting wire or pulling nails.
22) Channel-type Pliers	Opens wider than other pliers and provides long-handle leverage.
23) 1/2 Round Bastard Rasp	Use for rounding off edges of wood or shaping.
24) Firmer Chisel	Use for joint work or shaping on heavy work; Use wooden mallet to drive chisel.
25) Bevel-edge Chisel	Use for shaping, making mortises or joints.
26) Box Wrench	Use to grip nut or bolt heads where a wrench can be applied from the end of the work.
27) Open-end Wrench	Use where a wrench cannot be applied over the end of the work.
28) Adjustable Wrench	Same use as open-end wrench but can adjusted to fit.
29) Bench Plane	Use to smooth edge or doing chamfers and bevels.
30) Carpenters Level	Use for checking vertical surfaces for plumb or horizontal surfaces for level.
31) Combination Square	Use for marking cut lines or testing assemblies for squareness; Use for miter marking.
32) Steel Tape Rule	Measuring and marking wood.
33) Rafter Square	Tests squareness, marking right angles and calculating rafter cuts.

NAILS - CONVENTIONAL FORMS

SIZE	2d	3d	4d	5d	6d	7d	8d	9d	10d	12d	16d	20d	30d	40d	50d	60d
LENGTH	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5	5½	6
Common	876	568	316	271	181	161	106	96	69	63	49	31	24	18	14	11
Box	1010	635	473	406	236	210	145	132	94	88	71	52	46	35		
Casing	1010	635	473	406	236	210	145	132	94	88	71	52	46	35		
Finish	1351	807	584	500	309	238	189	172	121	113	90	62				
	Approx. No. of Nails Per Pound															

NAILS - SPECIAL PURPOSE

Wire Brads	3/16" to 3" Light work & molding
Cut	2d to 20d - Flooring; Construction
Roofing	Available in different lengths; Used for fastening flexible materials
Staging	Temporary construction work
Spike	6" to 12" - Heavy construction

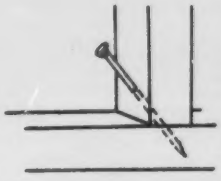
NAILING TIPS

Countersink

Avoid wood split

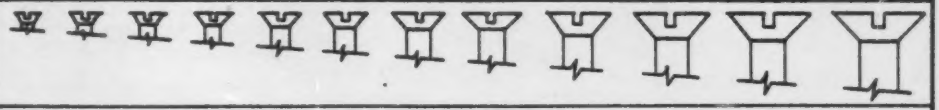
Clinching a nail

Toenailing



General Rule: A nail should be 2 1/2 to 3 times as long as the thickness of the board being nailed.

WOOD SCREW SIZES

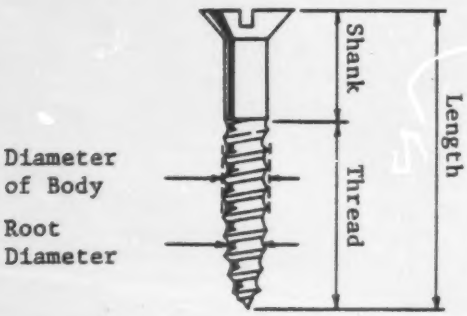
ACTUAL SIZE												
GUAGE #	2	3	4	5	6	7	8	9	10	12	14	16
LENGTHS AVAILABLE	¼"-¾"	¼"-1"	¼"-1¼"	⅜"-1¼"	⅜"-2½"	⅜"-2½"	⅜"-3"	½"-3"	½"-3½"	⅝"-4"	¾"-4½"	1"-5"

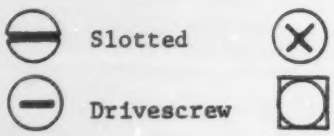
DESCRIPTION AND TYPES

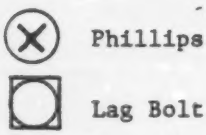
Screw size is designated by:

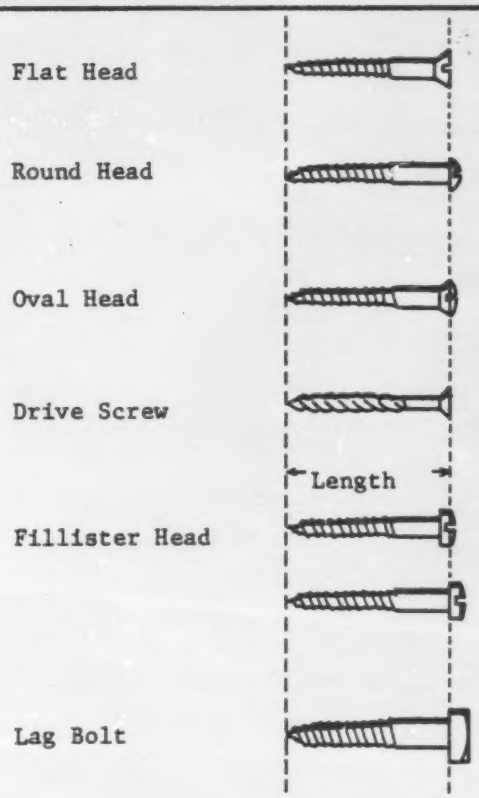
GUAGE# - Outside diameter of shank

LENGTH - Distance from point to base of head.

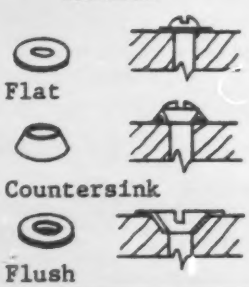


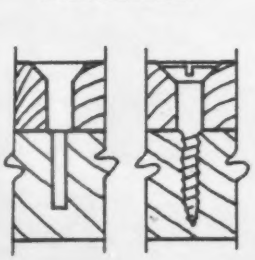


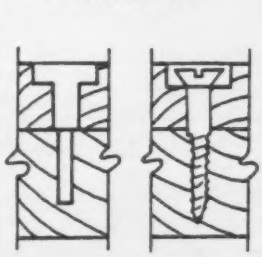


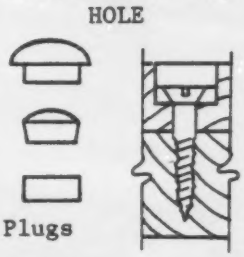


METHODS OF SETTING A SCREW





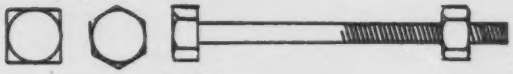




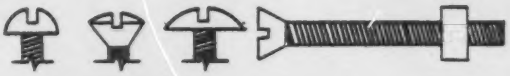
BOLTS

Carriage Bolt

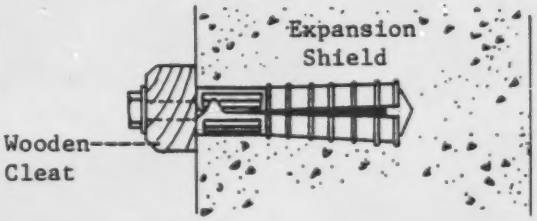
Machine Bolt



Stove Bolt

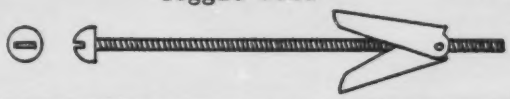


Masonry Bolt and Anchor



ANCHORING DEVICES

Toggle Bolt

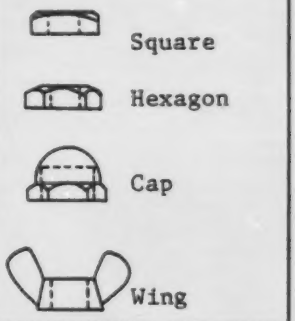


Plastic Expansion Anchor

Molly Bolt

WASHERS

NUTS



MISCELLANEOUS FASTENERS

Tacks

Fastening carpet or fabric to wood.

Glazier Points

Holding glass in place.

Upholstery Nails

Fastening upholstery to wood.

Corrugated Fastener

Light duty miter joints.

Escutcheon Points

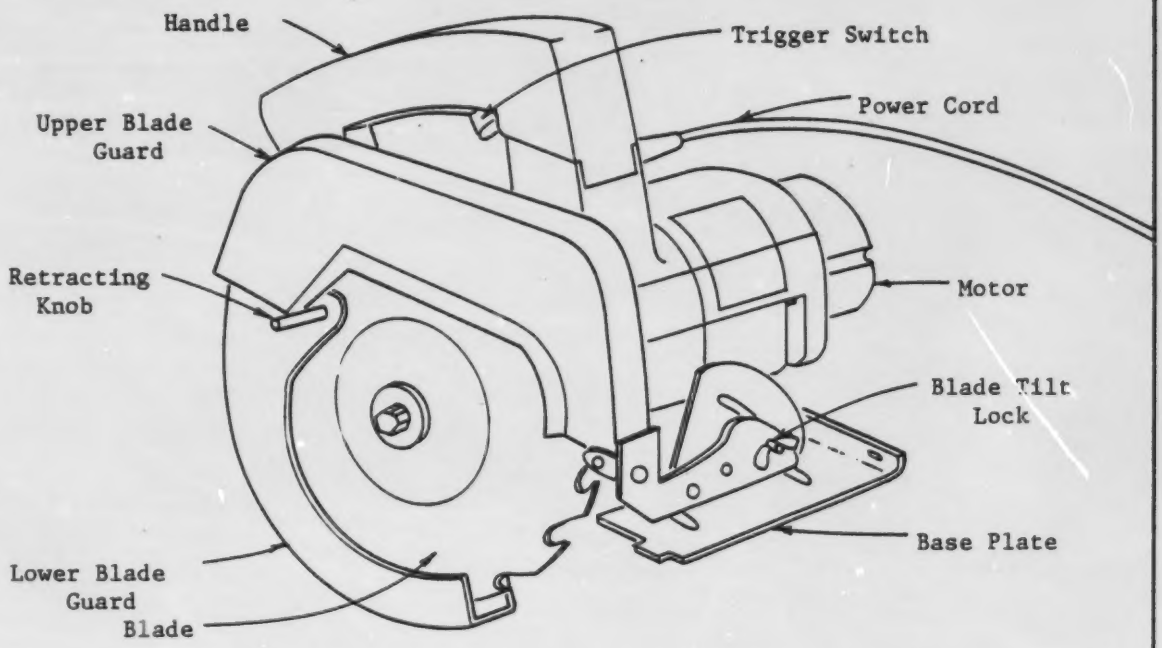
Decorating head; Attaching fixtures.

Staples

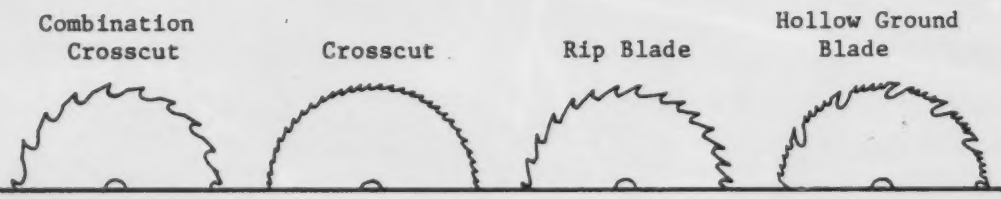
Many forms to hold various wire.

CIRCULAR POWER SAW AND BLADES

SAFETY TIPS: Always make sure that boards to be cut are firmly supported.
Start the saw before the blade enters the wood.
A long piece of wood should be supported by a helper.
Make sure that the cord is well out of the way.
Keep hands clear of the blade.
When replacing the blade, make sure that it is turning in the right direction.

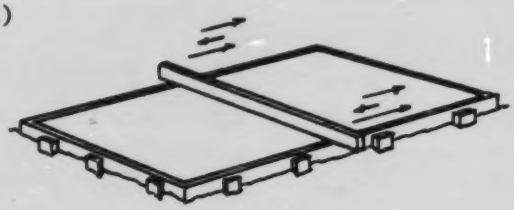


TYPES OF BLADES



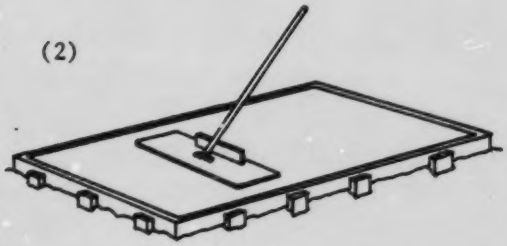
CONCRETE FINISHING

(1)



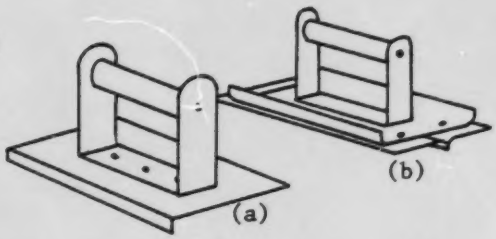
STRIKING OFF- Place a straightedge 2 x 4 across edge of forms and move it back and forth to fill in low spots and remove extra concrete.

(2)



BULL-FLOATING- Use a bull-float to level the concrete and fill in holes, directly after striking off.

(3)

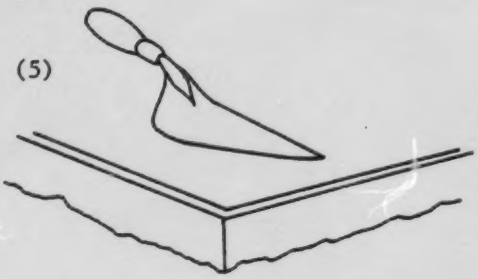


EDGING- Take a trowel and run a 1" groove between the form and the concrete; let the concrete set long enough so that an edger (a) can be used. Use jointer (b) to cut control joints.

(4)

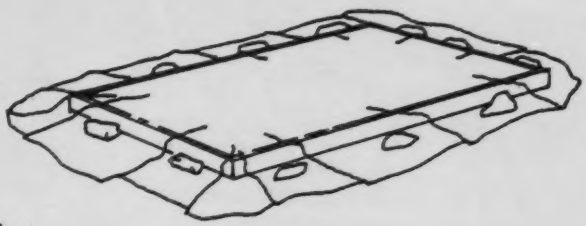
FLOATING- Hold float flat on surface and make sweeping arcs to level concrete.

(5)



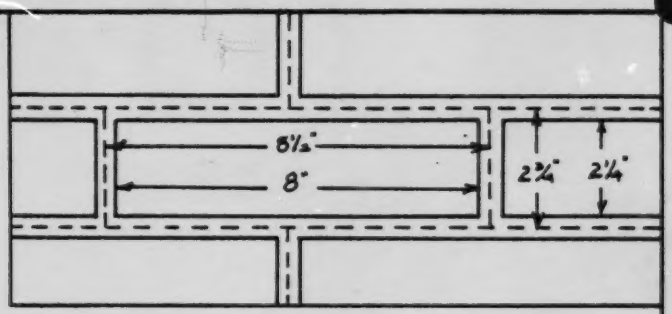
TROWELING- Use trowel flat to smooth surface; trowel again with edge upward.

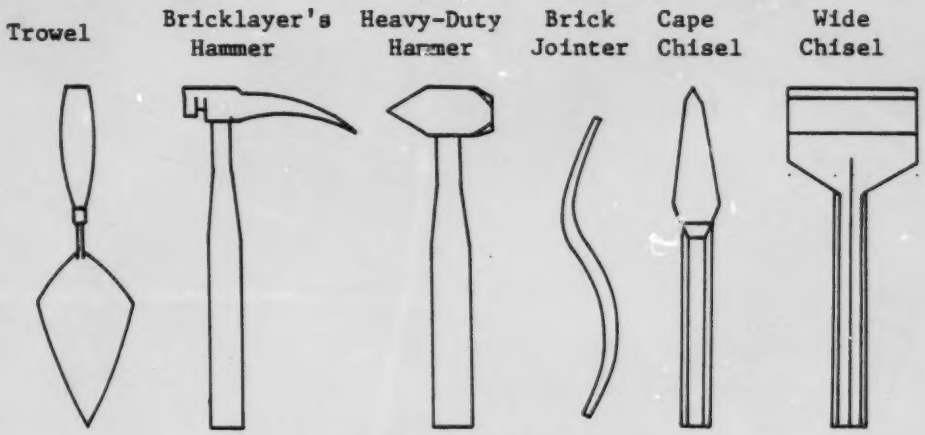
(6)



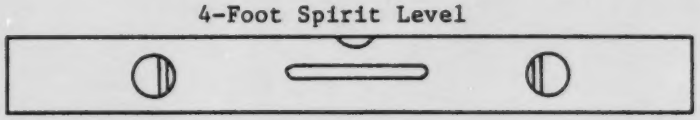
CURING- Cover concrete to keep it moist and warm while it hardens to increase strength (approx. 5-7 days).

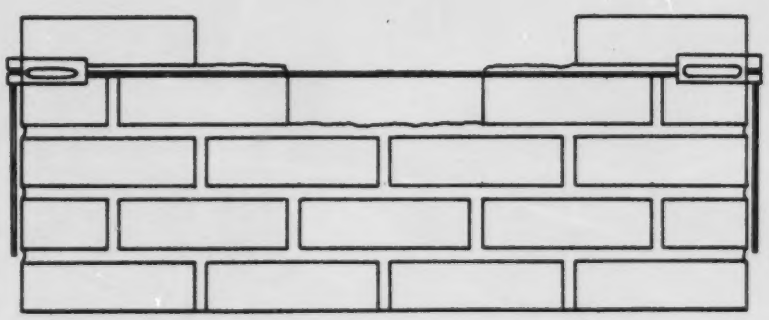
BRICKLAYING





4-Foot Spirit Level





Plastic line blocks are used to keep bricks level, plumb and alligned. Corner and end bricks are always built up first.

Name_____

Pay Period: From_____ To_____

JOB														Job Total
TOTAL HOURS														

RATE _____

GROSS _____

FED W/H _____

STATE W/H_____

S.S. _____

S.I.A.C._____

DRAWS _____

NET AMT. PAID _____

_____MILES@_____ _____

MAT'L _____

TOTAL _____

MACHINE SHOP

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
RELATED JOBS	1
METAL LATHE	2
SAFETY TIPS	3
SCREWDRIVER PROJECT	4

INTRODUCTION

The Machine Shop module will introduce you to working with machine tools such as the lathe, drill press, grinder, and milling machine. You will use the lathe to make a screwdriver from the plans you drew in Drafting. The work done by machinists must be precise and accurate. Machinists must also learn technical mathematics and the properties of different metals to become skillful in their trade.

RELATED JOBS

ALL-ROUND MACHINISTS

AUTOMOTIVE MACHINISTS

INSTRUMENT MAKERS

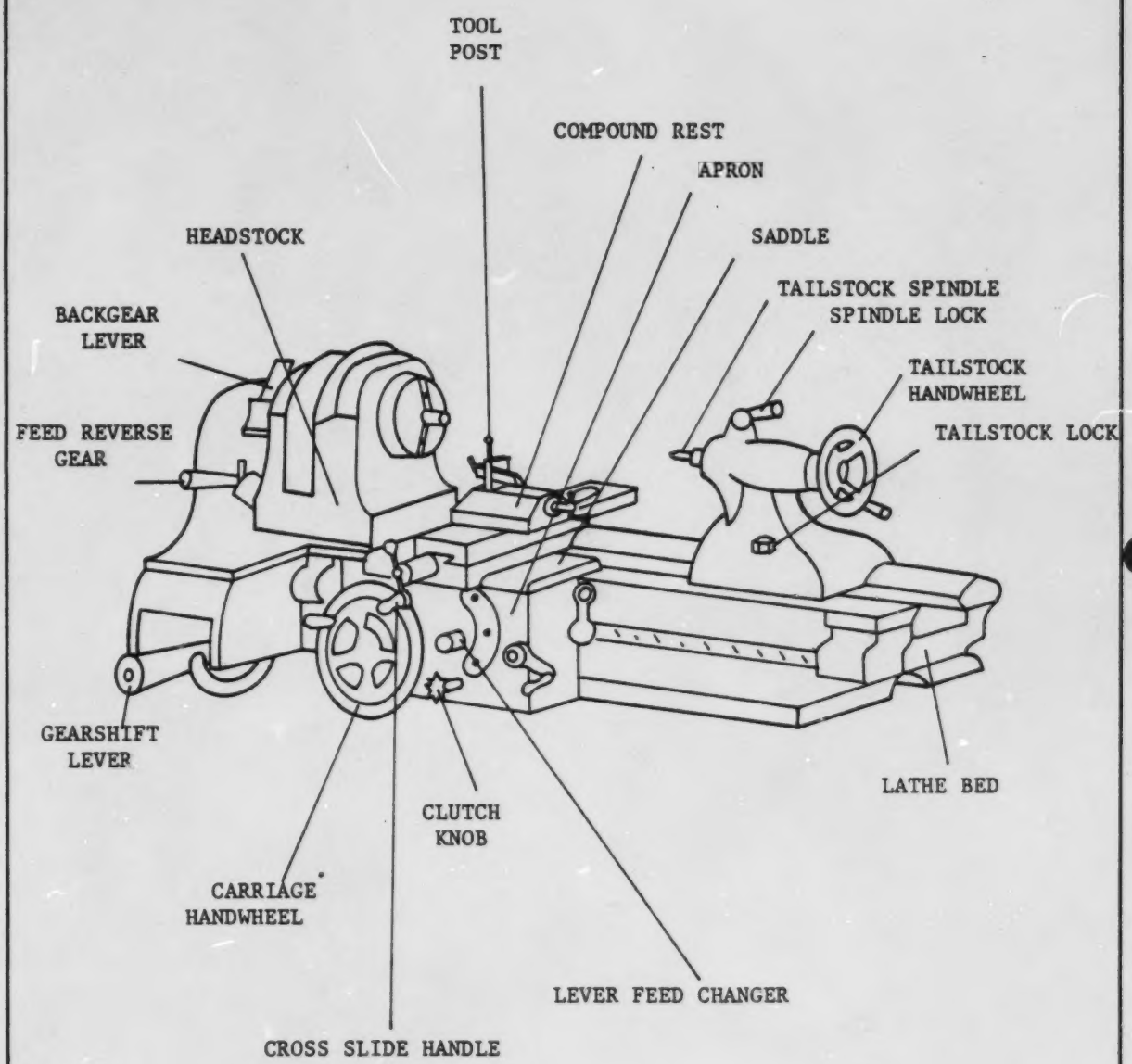
LAYOUT WORKERS

MACHINE TOOL OPERATORS

SET-UP WORKERS

TOOL AND DIE MAKERS

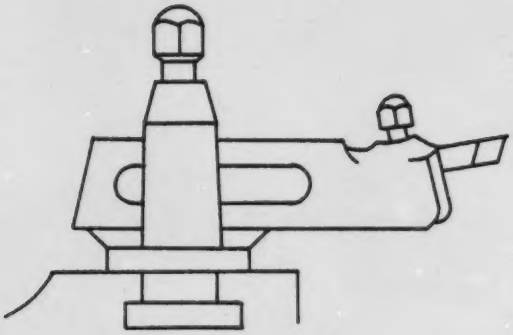
METAL LATHE


TOOL POST
COMPOUND REST
APRON
SADDLE
HEADSTOCK
TAILSTOCK SPINDLE
SPINDLE LOCK
BACKGEAR LEVER
TAILSTOCK HANDWHEEL
FEED REVERSE GEAR
TAILSTOCK LOCK
GEARSHIFT LEVER
LATHE BED
CLUTCH KNOB
CARRIAGE HANDWHEEL
LEVER FEED CHANGER
CROSS SLIDE HANDLE

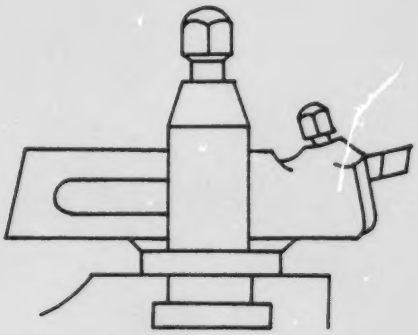
METAL LATHE SAFETY TIPS

1. The tool holder should be set as close as possible to the tool post and the tool should not extend more than 1/2" from the tool holder.

WRONG

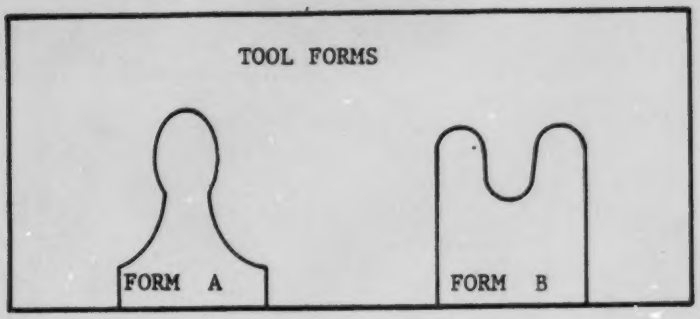


RIGHT



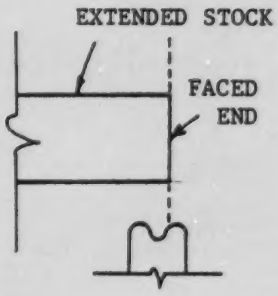
2. DO NOT USE YOUR HANDS TO HOLD WORK. There are a variety of work-holding devices used in the shop. Use a drillpress vise or a C-clamp. Special work holding devices are called FIXTURES. Special tool guiding devices are called JIGS.

SCREWDRIVER PROJECT

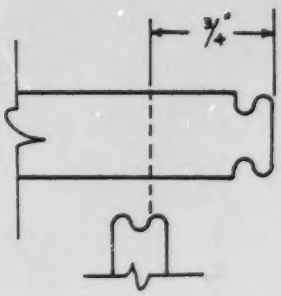


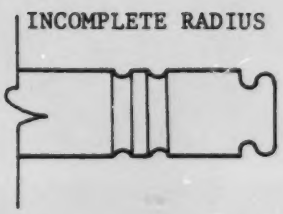
HANDLE

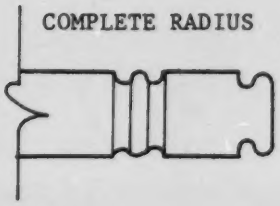
1. Chuck a piece of 3/4" aluminim stock with 2" extended.
2. Face off extended end with tool A and center drill with #3 center drill.
3. Set up form tool B; feed in crossfeed until tool makes a slight mark on outside diameter of stock, then set crossfeed dial to zero. With form tool adjusted to make a plunge cut to a depth of .125 (.250 on single depth lathe) with crossfeed.



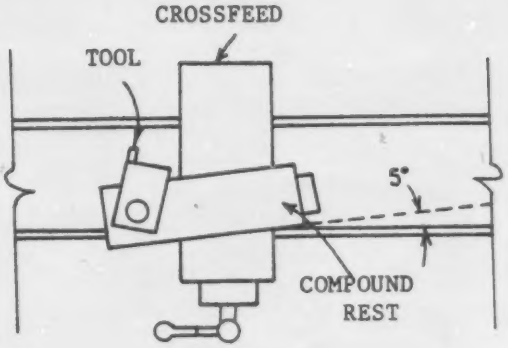
4. Scribe a mark at 3/4: from the end of the shaft; line up radius on form tool B so that mark is in line with approximately the same place as in step 3. Make a second plunge cut to a depth that makes a complete radius on the outside diameter of shaft.

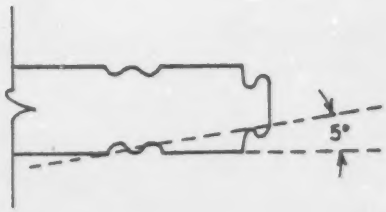






5. Set compound feed to make a 5° taper; change to tool A again and machine taper between two radii.

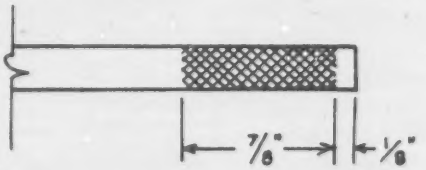




6. Re-chuck stock with 5"-6" extended; place a dead center in tailstock. With the tailstock in place and a knurling tool properly adjusted knurl approximately 4".
7. Replace dead center in tailstock with a drill chuck and drill a 1/4" hole that is 1 1/16" deep in extended handle.
8. Set up a parting tool and part off the knurled handle.
9. Take some brass shim stock, sheet aluminum, or several thicknesses of paper and wrap handle, then re-chuck with the parted off end extended and finish with tool A.

BLADE

1. Cut off a piece of 1/4" drill rod 5 1/4" long with a hack saw. Chuck into the lathe with approximately 3" extended.
2. With a hand knurling tool, knurl 7/8" of the extended end.



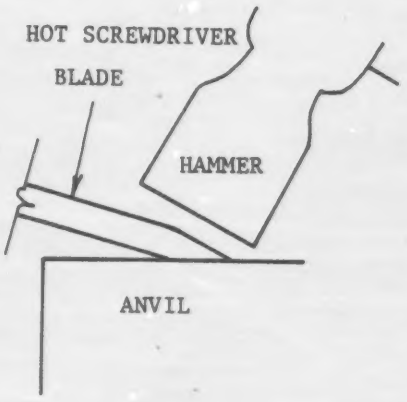
3. Make certain that the knurled end is de-burred and slightly tapered so that it can be pressed into the handle easily.

4. Place the blade into fixture with knurled end up and start the handle onto the shaft.
5. The handle can be either driven on with a hammer and a block of wood or pressed on with a hydraulic press.

TEMPERING THE BLADE

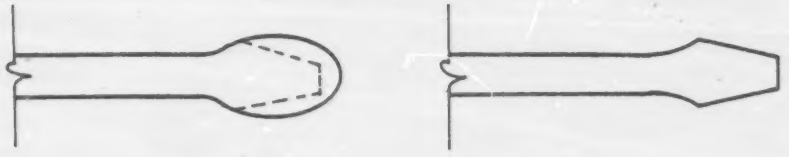
Now the blade can be heated, hammered, and ground into shape. Hardening and tempering will make it a usable tool.

1. Withan oxy-acetelyne torch, heat 1 1/2" of the end of the blade to a bright red and hammer the tapered shape of the blade.



2. Now you are ready to grind the blade into its final shape.

FROM THIS TO THIS



The hammered sides may be ground if the blade is too thick, or if there are hammer marks.

3. Again, with the oxy-acetelyne torch, heat approximately 2" of the finish shaped blade to 1550° (Cherry red) and quench immediately in oil. This is the hardening process and the blade is very brittle at this point so it must be softened a little by tempering so that it is tough and durable.

4. Tempering is accomplished by re-heating to a much lower temperature. This may be done by several different methods: with a hot plate, oxy-acetelyne torch, or a butane or propane torch.

   If using a torch you must BE VERY CAREFUL NOT TO OVERHEAT THE BLADE. Heat approximately 3 1/2" of the blade by fanning the blade with the flame. Start heating the shank and the thicker part of the blade first so that it will temper more evenly. During this process we want to quench the blade when it reaches 500° (Blue).

WELDING

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INTRODUCTION

Welding is a professional and highly skilled trade. Those who wish to pursue welding as a career should be ready for hard work and responsibility. In an era when credibility is always being questioned, your expertise is your only defense. In recent years, the steel workers trade has been diluted by quick contact welding "professionals" who do not meet certification standards and do not really know what welding is all about. A good welder makes it their business to know the right procedures and work so that each weld is a work of art, skill and pride.

Learn all you can in a formal program and on the job; distinguish between those who know their work and those who just say they do. Become a professional and know that the job you are doing is the best that you can do, work hard and ask questions. Learn from mistakes rather than being afraid of them as it is your responsibility to become as proficient as you can at your job.

RELATED JOBS

ARC WELDERS

GAS WELDERS

RESISTANCE WELDERS

BRAZING & SOLDERING OCCUPATIONS

LEAD BURNING OCCUPATIONS

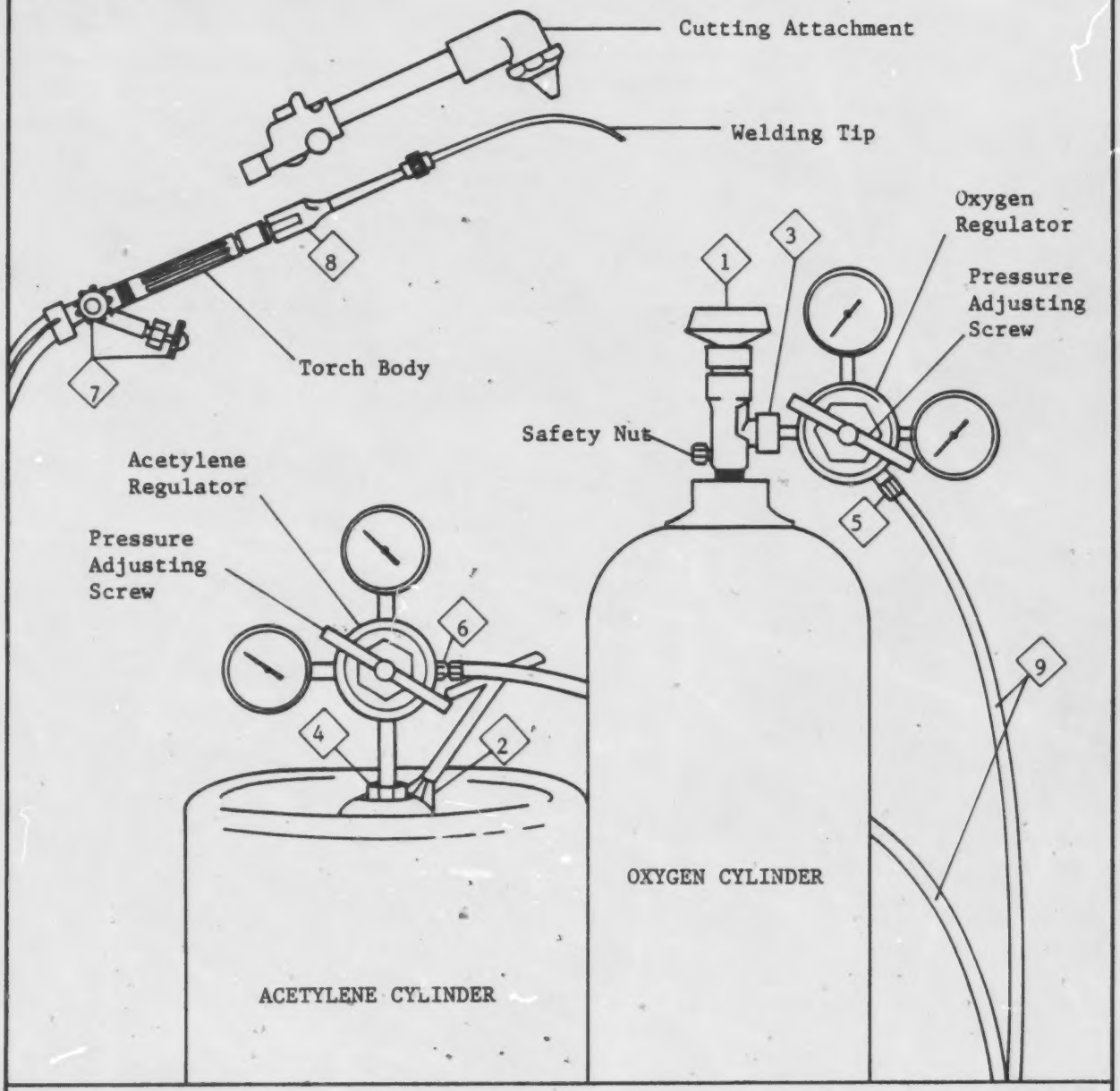
FLAME & ARC CUTTERS

METAL FABRICATION

WELDING DRAFTSPERSON

PIPE FITTER

EQUIPMENT



POINTS TO CHECK FOR LEAKAGE:

1) Oxygen cylinder valve
2) Acetylene cylinder valve
3) Oxygen regulator connection
4) Acetylene regulator connection
5) Oxygen hose connection
6) Acetylene hose connection
7) Oxygen and Acetylene needle valves on torch
8) Welding tip connection
9) Hoses

PERSONAL SAFETY TIPS

1. Wear dark goggles when cutting or welding.
2. Wear heat resistant, gauntlet gloves.
3. Keep clothing free from grease or oil.
4. Wear fire resistant clothing when using welding equipment.
5. Do not wear loose clothing.
6. Wear a respirator when bronze welding, welding galvanized iron, or welding or cutting materials which contain beryllium, cadmium, zinc or lead.
7. Do not operate pneumatic tools with oxygen.
8. Have a fire extinguisher handy at all times.
9. Use equipment in well ventilated area.
10. Take good care of welding and cutting apparatus to insure safe operation.
11. If you are not sure how to use the equipment, NEVER GUESS. Ask your instructor.
12. Make sure that you are not using defective equipment.

FUNDAMENTAL PRINCIPLES OF WELDING

Acetylene burned with oxygen produces an extremely hot flame that is sufficient to melt and fuse heat-resistant metals.

A steady flow of oxygen directed at a peice of metal that has been heated to its kindling point will cause burning or oxidizing of that metal.

OXYGEN CYLINDERS

The most common method of transporting and storing oxygen and acetylene uses cylinders. Oxygen cylinders are made from seamless, drawn steel. There are three sizes of cylinders:

SMALL	Contains 80 cubic feet.
MEDIUM	Contains 122 cubic feet.
LARGE	Contains 244 cubic feet.

It requires a pressure of 2200 pounds per square inch (at 70° F.) to charge (fill) cylinders with oxygen. Temperature changes will affect the oxygen pressure. Only the pressure changes, not the amount of gas in the cylinder.

TEMPERATURE INCREASE	causes	PRESSURE INCREASE
TEMPERATURE DECREASE	causes	PRESSURE DECREASE

The Safety Cap must always be in place whenthe cylinders are being stored or handled. This safety cap screws onto the cylinder cap ring to protect the valve against breakage. NEVER lift the cylinder by the safety cap.

The Safety Nut is a device that will slowly reduce the cylinder pressure if it becomes too high. At 2840 pounds per square inch of pressure within the cylinder, or at 240° F., the disk will burst or melt to allow the oxygen to escape through the holes in the safety nut.

The Oxygen Cylinder Valve should be opened wide when in use. The valve has a back seating seal which must be engaged to prevent the oxygen from escaping around the valve.

NEVER expose the cylinder to high temperatures.

ACETYLENE CYLINDERS

Free Acetylene Gas is dangerous when used beyond 15 pounds of pressure because it is highly combustible. The gas is colorless but it is easily recognizable by its distinct and nauseating odor. Under low pressure it is stable and may be used safely.

Dissolved Acetylene can safely be stored at 250 pounds of pressure because of the specially designed high pressure cylinders and storage procedures. Acetylene cylinders come in three sizes:

SMALL	60 cubic feet
MEDIUM	100 cubic feet
LARGE	300 cubic feet

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Acetylene cylinders should ALWAYS be stored in an upright position. Cylinders stored on their side (horizontally) can become clogged and dangerous to use. Horizontal storage can also cause the acetylene to become unstable. You must use caution and care when handling these cylinders.

The valves on the cylinders vary accoring to different manufacturers' designs. Do not open the valve more than one turn; this makes certain that it can be closed quickly in case of an emergency.

Safety plugs are located on the top of the cylinder and to the side of the valve. If the cylinder becomes too hot, a low temperature lead within the plugs will melt and allow the gas to slowly leak out. This eliminates the possibility of an explosion. Two more safety nuts are located at the bottom of the cylinder.

CYLINDER SAFETY RULES

1. Keep cylinders securely fastened in upright position at all times.
2 While cylinders are in storage, the safety cap must be in place.
3. The oxygen cylinder valve should be opened all the way when in use.
4. The acetylene cylinder valve should not be opened more than one turn when in use.
5. Do not expose cylinders to excessive heat or open flame.
6. Do not use oxygen as air to blow off clothing or work space.
7. Do not use grease or oil around or on any welding or cutting apparatus.
8. Never use cylinders for rollers.

OXY-ACETYLENE EQUIPMENT

All welding equipment is safe when used and handled properly.

Regulators and hoses are color coded. RED is for acetylene. GREEN or BLACK is for oxygen.

Fitting on oxygen equipment have right hand threads. Fittings on acetylene equipment have left hand threads. Always use the proper wrench size when adjusting fittings; they are made of brass and are easily ruined.

Common regulators have two pressure gauges: one shows the pressure remaining in the tank; the other shows the pressure that is passing through the hoses.

Use a combination torch when welding and cutting can be done with the same equipment.

EQUIPMENT SAFETY RULES

1. Always use oxygen through a regulator.
2. Keep oxygen fittings away from oil and grease.
3. Lubricate only with glycerine or soap.
4. Never use a leaking cylinder.
5. When testing equipment for leaks, use a soft brush and soapy water.
6. Always wear goggles when cutting or welding.
7. Never light a torch with both valves open.
8. When opening valves, always stand to one side and open the first turn very slowly.
9. Never use a match to light a torch; always use a spark lighter.
10. Never strike an arc on oxy-acetylene cylinders.
11. Never cut or weld any closed container without thoroughly cleaning it. Containers may have held substances that can create explosive or toxic fumes when heated.

ASSEMBLY AND TURN-ON PROCEDURE

Refer to Equipment diagram (Page 2) while following each step in the procedures. If you are not sure of what you are doing, ask your instructor.

1. Mount and secure cylinders to a stationary object (or portable cart) and keep keep them in an upright position.

2. Remove safety caps.

3. Open and close valve quickly to blow out foreign material (referred to as cracking the valve). Do not stand in front of the valve. If valves are hard to turn, place both palms down on top of hand wheel, push down and give a quick jerk counter-clockwise.

4. Check the oxygen cylinder valve outlet and regulator threads for damage. Attach oxygen regulator to the oxygen cylinder (color code green). Attach acetylene regulator to acetylene cylinder (color code red). Use correct wrench fitting.

5. Make sure regulator is off by checking the oxygen regulator pressure adjusting screw. Open the cylinder valve very slowly until it is wide open. Now turn the pressure adjusting screw in until a small amount of oxygen flows through the opening where the hose will be attached. Close the cylinder valve and release the pressure regulating screw.

6. Attach oxygen hose to oxygen regulator (right hand threads).

7. Repeat Step 5 with acetylene equipment but only open valve 3/4 turn.

8. Attach acetylene hose to acetylene regulator (left hand threads).

9. Attach end of hoses to the fittings of the welding torch and tighten all fittings.

10. Attach a welding tip to the torch and tighten by hand.

11. Open the acetylene cylinder 3/4 turn.

12. Make sure the torch needle valves are closed.

13. Starting with the oxygen, open torch needle valves 1/4 turn so that you can tell the working pressure.

14. Slowly turn the pressure adjusting screws clockwise until the desired pressures show on the gauge. Pressure must be appropriate for size of tip being used. Close the torch needle valve.

15. Repeat Steps 13 and 14 for acetylene. Remember, acetylene becomes unstable over 15 pounds per square inch. Check this pressure carefully.

16. Make sure all fittings are secure but not over tightened. Check for leaks. DO NOT USE A FLAME TO TEST FOR LEAKS because gas may have accumulated and the flame could cause an explosion. Refer to areas numbered 1-9 on Page . which need to be checked for leaks.

17. The equipment is assembled and is ready to be used.

TURN-OFF PROCEDURE

1. Close acetylene cylinder valve.
2. Close oxygen cylinder valve.
3. Open (bleed) acetylene torch valve to drain gas; the, close valve.
4. Turn pressure adjusting screw counter-clockwise to release pressure.
5. Open oxygen torch valve to drain oxygen; then, close valve.
6. Release pressure adjusting screw.
7. Remove tip.
8. Store equipment properly.

INDUSTRIAL ENVIRONMENTS

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CHARACTERISTICS OF INDUSTRIAL ENVIRONMENTS

The world of work is complex and the characteristics of occupations are dependent upon location, the composition of the workforce and the philosophy of management, as well as the actual work to be preformed.

Some jobs will be indoors, as in a manufacturing plant, others will be outdoors in one or varied locations, and some will combine both indoor and outdoor work. Most jobs have different schedules, physical facilities, sounds and smells to learn as well as specific technical skills.

All jobs will require social skills in relating to employers, co-workers, and the public. You will be expected to understand and follow oral and written directions, and possibly to also give instructions to others. You will be expected to get along with others on the job so that the work is not disrupted.

The majority of the industrial workforce has been male and in this time of transition a woman will encounter a variety of attitudes from supervisors and co-workers. You will need to have a knowledge of stereotyping, its disadvantages and advantages, and the skills necessary to succeed in a non-traditional environment if you are a woman. If you are a man you need to know how stereotyping affects your work experience and understand the changing world of work. There are discrimination factors which you need to be aware of before you ever go to that first job interview and skills to learn to successfully handle discrimination, patronizing behavior, subtle or overt sexual acts, hazing, isolation tactics, or harrassment. We encourage you to learn the skills necessary to handle the inter-personal aspects of work as well as the technical skills necessary to get the job.

More people lose their jobs because of inter-personal problems than because of technical skill limitations.

As you explore industrial occupations in Industrial Orientation you need to look at the working conditions, workforce, salaries, fringe benefits, attitudes and unions to understand the realities of the work world. It is not enough, however, to look only at the external work world; you must also look at your interests, abilities, skills, and potential technical training to make a career decision that will be good for you. It is important to look at your personal priorities and responsibilities: home, the amount of money you need to support your desired lifestyle, possible conflicts with parenting, the attitudes and expectations of friends and relatives, the kind of support system you have available or can create, committment to a relationship or geographic location. All these external and personal factors must be considered in your career decision.

As you go through each module in Industrial Orientation ask yourself these questions:

Which things are interesting? Which part makes me want to know more? Why is this part interesting to me?

Which things are boring? What is it that bores me-the information or the way it is presented? Am I bored by terms, sitting in one place, using the tools?

Which physical environment do I like? Which sounds, smells, tools and materials do I like to be around?

What skills do I seem to learn the fastest? Why?

What things scare me? What can I do about overcoming the fear?

How much am I getting out of this module? How can I get what I need, more of what I need, or less of what I don't need?

Do I need to learn to be more flexible?

Do I ask enough questions to get the information I need? Am I afraid to ask again if I did not understand the first time?

What is the difference between the students who seem to learn

the most and the student who does not seem to be getting much out of this?

Can I pick out the people I would hire if I was an employer? Would I hire me if my business depended on the quality of employees I hired? What qualities would I look for in employees?

You are likely to benefit most from Industrial Orientation if you come to class consistently and try all class experiences. As on a job, you will find some things more interesting than others but you can learn even from boring experiences. Please ask questions in class and look for more information from outside sources--instructors, counselors, the Women's Awareness Center, the CIS system, the library, or people employed in interesting jobs. Notice all the working people you see daily and ask yourself if you would like that job and what training is required to get that job. Being curious and working at planning your career are two of the most beneficial things you can do for yourself.

It is your life and your career. Our goal in Industrial Orientation is to be of assistance in making your choice a rewarding reality for you. Keep in touch, both during class and after the term ends-- we care about you and your future and would like to continue to be helpful.

TESTS AND RESOURCES

Basic career guidance tools and campus resources can assess your interests and plan your career successfully. No test or person knows you better than you know yourself (if a test result seems wrong then look at it to see if the questions fit for you), but they can be very helpful in making your picture of yourself clearer.

Some useful tools and resources are:

STRONG-CAMPBELL INTEREST INVENTORY Describes your pattern of interests in six major themes which include many occupations. Testing Office, $2.00 fee.

CAREER ASSESSMENT INVENTORY Similiar to the STRONG-CAMPBELL but uses more direct questions and focuses on trade occupations. Testing Office, $2.00 fee.

CIS COMPUTER TERMINAL A personal job list based on your answers to questions in standard booklet. Job information for local, regional and national facts. Lobby of Center Building, free.

COGNITIVE MAPPING Focuses on your preferred learning styles. Helpful for understanding how you learn best and how that affects class and job choices. In class, free.

COUNSELING The Counseling Department has counselors available to discuss career planning, personal issues, school concerns. Your instructor will also be available for individual career planning and strategies.

FINANCIAL AID Can provide financial help to qualified students. Lobby of Center Building.

WOMEN'S AWARENESS CENTER A good place to know, helpful resource and referral center with good library. Center Building.

Cognitive Mapping will be done in class. If you wish to have your Strong-Campbell Interest Inventory or Career Assessment Inventory interpreted in class you must take the test during the first three weeks of the term to allow time for your test to be scored. For in class interpretation you should put your instructor's name for counselor on the card you fill out in the Testing Center.

An Industrial Orientation reading file is available in the Women's Awareness Center. You may read the articles there or check them out overnight.

WOMEN AND WORK

There are some facts about women in the workforce you should know. Women are now 53% of the workforce in this country. More than 40% of working women are heads of household. More than 40% of working women are married with children under 18. 90% of all women will be employed sometime in their lifetime. This sometime is an average of 25 years for married women, 45 years for single women compared to 43 years for the average man.

A majority of women have clerical, service, or private household jobs; in the majority of well paying jobs, women are not well represented. Women are less than 5% of the skilled craft workers and less than 20% of all managers. The stereotype of women is the full-time homemaker but the reality is much different. Most women need to work yet most women high school graduates earn less than men who only finished the eighth grade.

Why should women consider non-traditional jobs? There are several answers when we look at economic and work realities. Traditionally male jobs pay better than traditionally female jobs; women work 9 days to earn what men earn in 5 days but no grocer or landlord is going to charge you half the going price so a woman needs two traditional or one non-traditional job to keep up. Not every women finds traditional women's jobs interesting; many women have interests and skills that mean they find non-traditional jobs more rewarding. Women who want careers can find opportunities for upward mobility in non-traditional jobs. The labor forecasts for jobs in the skilled trades indicate many jobs will be available.

The composition of the workforce is changing; women and men are choosing non-traditional jobs. New laws have helped but cannot open the doors without each worker's individual effort. Women and men entering non-traditonal fields need skills to meet job requirements, attitudes of co-workers, and illegal employment practices. Each worker needs to find role models and mentors to help in the transition and share their experience with the workers who follow.

SEX STEREOTYPE INFORMATION QUIZ

1. Women are now 53% of the labor force. True False

2. Men with grade school educations earn more than most women high school graduates. True False

3. More than 40% of women workers are married. True False

4. Men are moving into traditional "women's jobs" more than women are moving into traditional "men's Jobs." True False

5. Men must be responsible for supporting their families. True False.

6. Who has the highest unemployment rate? Men? Women?

7. Most women work only for extra spending money. True False

8. Men have more high blood pressure, heart attacks, suicides, and alcoholism than women. True False

9. Men should always act like they know what they are doing. True False

10. Most women are not very capable, and should leave important decisions and hard work to men.

11. Men should help women co-workers with the "heavy" jobs. True False

12. Stereotypes only affect women. True False

13. Who is able to do each of these jobs?

Truck driver	Men	Women	Both	Mechanic	Women	Men	Both
Nurse	Men	Women	Both	Cook	Women	Men	Both
Electrician	Men	Women	Both	Drafter	Women	Men	Both
Logger	Men	Women	Both	Bricklayer	Women	Men	Both
Welder	Men	Women	Both	RR Engineer	Women	Men	Both
Secretary	Men	Women	Both	Child care	Women	Men	Both
Machinist	Men	Women	Both	Plumber	Women	Men	Both
Green chain	Men	Women	Both	Framer	Women	Men	Both

14. Does the description make you think of men or women?

Hard worker
Aggressive
Needs encouragement
Easily taken advantage of by others
Likes challenges
Earns "good wages"
Good at resolving problems with other people
The "boss," supervisor, or crew leader
Must work to support a family

INFORMATION ABOUT

APPRENTICESHIP TRAINING

"Earn While You Learn"

APPRENTICESHIP IS:

- A Working Education

  The Employer agrees to teach the apprentice on the job. The apprentice is expected to make a profit for the employer.

  The Apprentice agrees to learn.

  Related Training is required. The apprentice must attend school after working hours for 144 hours a year. Classes are generally held twice a week, at night, during the school year.

  Training Period varies from one to five years. Most programs last 3 years.

  Wages generally start at 50% of the wages for a fully trained craftsperson. In most occupations the pay increases 5% each 6 months if the apprentice is making satisfactory progress. Wage rates change constantly and vary among occupations.

- Used by 140 Occupations in Oregon

  The most popular occupations include the following:

  Building Trades

  1. Bricklayer
  2. Carpenter
  3. Cement Finisher
  4. Construction Electrician
  5. Construction Ironworker
  6. Floor Coverer
  7. Glass Worker
  8. Lather
  9. Painter
  10. Plasterer
  11. Plumber/Steamfitter
  12. Sheet Metal Worker
  13. Tile Setters

  Metal Trades

  1. Machinist
  2. Mechanic, Auto
  3. Mechanic, Diesel
  4. Operating Engineer
  5. Tractor & Heavy Duty Equipment Mechanic

  Industrial/Manufacturing Trades

  1. Boilermaker
  2. Electrician, Manufacturing Plant
  3. Iron Workers, Shop
  4. Millman, Cabinetmaker
  5. Molder, Coremaker
  6. Patternmaker

  Service Trades

  1. Appliance Repairer
  2. Baker
  3. Cook
  4. Radio/TV Repairer
  5. Office Machine
  6. Printer
  7. Meatcutter

- Available to Qualified Applicants

  Minimum Age is generally 18 years. Most employers prefer older apprentices for their work experience and maturity. Employers will take young persons who have skills and knowledge of the trade obtained through school or work experience.

  Minimum Education for submitting an application for most occupations is a high school diploma or GED. Some trades require specific subjects such as algebra and geometry. Opportunities for apprenticeship are improved if vocational training is taken in high school or community college. Reading, communication skills, and basic mathematics are subjects that should be taken to prepare for apprenticeship.

  Physical Requirements are those necessary to work in the trade. A tile setter applicant must be able to lift a bag of cement weighing 94 lbs. An electrician must be able to see colors of wires.

  Aptitude Tests are used for some occupations. The GATB test given at employment offices is used for measuring space and form perception, numerical skills, finger skills and manual dexterity.

APPLY FOR APPRENTICESHIP TO:

- Oregon Apprenticeship Information Centers

  Portland Information Center 1437 SW 4th Avenue, Portland, 97201, 229-6080.

  Eugene Information Center 432 W 11th, Eugene, 97401, 686-7525.

- Oregon Bureau of Labor

  Apprenticeship & Training Division, State Office Building, 1400 SW Fifth Avenue, Portland, 97201, 229-6008 or toll-free number 1-800-452-3503.

  Pendleton Apprenticeship Office 700 SE Emigrant, Suite 320, Pendleton, 97801, 276-7884.

  Salem Apprenticeship Office 115 Labor & Industries Building, Salem, 97310, 378-3286, toll-free number 1-800-452-7813.

  Eugene Apprenticeship Office 541 Willamette Street, Eugene, 97401, 686-7623.

  Bend Apprenticeship Office 1250 Studio Road, Bend, 97701, 389-1505.

  Coos Bay Apprenticeship Office 455 Elrod, Coos Bay, 97420, 269-1161.

  Medford Apprenticeship Office 140 N Grape Street, Medford, 97501, 776-6013.

- All Local Employment Division Offices

PREPARE FOR APPRENTICESHIP:

- Check Selection Procedure for Apprentices

  Open Period for Applications for apprenticeship is limited to two weeks a year for many occupations. Application must be made at this time to qualify for selection. Some of the popular construction occupations such as construction electrician, carpentry, plumbing, bricklaying, and sheet metal are open for applications *only two weeks of the year.*

  A normal part of seeking employment is the initiative of the applicant to learn how and where applications can be made. Check with Apprenticeship Information Center, local office Division of Apprenticeship, or the Employment Office for information about *open periods* for making application for apprenticeship. Or call these toll-free numbers: Salem 1-800-452-7813 or Portland 1-800-452-3503.

  Selection Process varies with occupations.

  Plan "A" used by construction electricians places applicants on a list in rank order with top rated applicants at top of list. Apprentices are sent to jobs by taking the top person from the list.

  Plan "B" is used by large companies. A list of eligible applicants is established from *present* employes of the company. A bidding process is generally used and the employe with the most seniority or years of employment with the company gets the apprenticeship job. The bargaining contract or union agreement may permit the company to select the best qualified candidate.

  Plan "C" is used by most occupations. Apprentice applicants are placed on the *eligible* list and employers may select any applicant on the list. This encourages persons on the list to look for employers.

  "No Plan" is used by occupations with less than 5 registered apprentices. Any person who can find an employer willing to hire an apprentice can become registered by appearing before the joint apprentice committee. The employer must be approved by the joint apprentice committee.

- Preparatory Programs for Apprenticeship

  Basic School Subjects recommended for persons interested in apprenticeship include those classes that provide communication and mathematical skills.

  Pre-Job Training can be obtained by taking vocational classes in welding, foundry, industrial arts, construction cluster, machine shop cluster, blueprint reading and sketching, and Cooperative Work Experience.

  Pre-Apprenticeship is sometimes available through CETA programs. Several trades including bricklayers, floor coverers, cement masons, and carpenters have industry sponsored programs. Participants in these programs are preselected by the joint apprentice committees.

  The Apprenticeship Law and Apprenticeship Council policy encourages joint apprentice committees and schools to cooperate in conducting pre-apprentice classes.

DISCRIMINATORY INTERVIEW QUESTIONS

These questions are illegal in pre-employment interviews unless a pre-employment security investigation is required for the job. After hiring, employers may ask for some-information necessary for carrying out an affirmative action program. Not all employers ask legal questions in job interviews. You may want to weigh your right to not answer illegal questions against your need for the job but you should remember that the type of interview may well indicate the work climate with that employer and your potential satisfaction with the job.

It is illegal for an employer to ask your age.

It is illegal for an employer to refuse to hire a women because she has young children or to ask about child care arrangements. That does not mean, however, that it is okay to be absent frequently because of children's appointments or illnesses.

It is illegal for an employer to ask if you have ever been arrested. It is also illegal to use a conviction record as an automatic bar to employemnt. Some convictions may bar a person from some jobs, however.

It is illegal to ask about citizenship. This could indicate national origin.

It is illegal to ask about your credit history such as do you own or rent your home, do you own a car, have you ever had your wages garnished? Your credit history has no effect on your ability to do the job.

It is illegal to ask about eye or hair color which could indicate national origin or race.

It is illegal to ask your height or wieght unless height or weight is a bonafide job requirement.

It is illegal to ask if friends or relatives work for the employer. This may be used to give preference to relatives of current employees or discriminate against against women and minorities.

It is illegal to ask marital status or pay a married women less than a married man for the same job.

It is illegal for an employer to refuse to hire women because of their personal relegious or moral beliefs.

It is illegal to ask your maiden name or previous married name. These can be clues to national origin and only affect women since men do not change name with marriage.

It is illegal to ask the sex of the applicant unless sex is a bonafide job requirement. There are few bonafide exceptions such as female model for women's fashions.

It is illegal to hire by word of mouth if the majority of workers are white and male.

AFTER INDUSTRIAL ORIENTATION, WHAT NEXT?

Now that you have become familiar with the trades in Industrial Orientation, and perhaps selected your career field, you need to plan your next steps. Specific technical training in your chosen field is important but some harder to define social skills will also be necessary for success in the work world. It has consistently been proven that more people lose jobs or quit because they lack the social skills necessary for successful job experience than because they lack technical expertise.

Some helpful classes you can take are:

ASSERTIVENESS TRAINING (HUMAN RELATIONS II) for building skills necessary to manage your work experience successfully.

HUMAN RELATIONS I can help you learn communication skills .

JOB SKILLS LAB can help you learn to present yourself well with resumes and interview techniques. A good place to practice before you try it with employers.

WOMEN'S STUDIES can give you a better understanding of the history and direction of women in our society.

COPING SKILLS can help you learn ways to prevent stress and depression from getting in your way.

Two specific areas of training are important parts of your career needs; math is important for everyone, physical training is important for many of the skilled trades. 90% of the jobs in this country require some kind of math skills; the skilled trades require workers with a good knowledge of basic math but many also require algebra, geometry, or other technical math. You will also have more opportunities for change and promotion with a solid math background. The Math Resource Center is very helpful for evaluating and improving your math skills, and the department has a special class for people who are afraid of math.

Physical conditioning is also necessary for many jobs in the skilled trades. Courses in the PE Department can help you build the strength, agility and fitness needed for many jobs. You may not be able to meet the physical requirments now, but with proper training you can overcome those traditional barriers.

ELEMENTS OF COGNITIVE STYLE

Theoretical Symbols

The first set of elements are theoretical symbols and qualitative symbols. The theoretical elements include the same areas that are measured on virtually all academic aptitude, achievement, or ability tests, i.e., verbal and mathematical. They are commonly considered essential for academic success. On your Cognitive Style Map, they are referred to as Linguistic(verbal) and Quantitative (numerical) and are symbolized by the letters L and Q respectively.

This map is different from achievement or ability measurements in that it helps measure your **preference** for working with words or numbers that you SEE and with those you HEAR. Hence, we have:

1. T(AL) **Theoretical Auditory Linguistics** - Finding meaning through words you hear, a preference for hearing words.
2. T(AQ) **Theoretical Auditory Quantitative** - Finding meaning in spoken numbers, preferring to hear non-word symbols.
3. T(VL) **Theoretical Visual Linguistics** - Finding meaning from words you see, preferring to read.
4. T(VQ) **Theoretical Visual Quantitative** - Finding meaning in numerical symbols, a preference for seeing non-word symbols.

Stop now and review your scores on the first four elements. Fill in the work sheet at the end of this Guide. Do your scores uncover your preferred learning styles?

Qualitative Symbols

Since it is assumed that theoretical ability is supplemented by other abilities, we must consider the personal abilities you have. There are sixteen qualities that will be shown on your map and scored again as Major, Minor, or Negligible.

The first of these qualities are those which indicate meaning perceived through the basic senses. They are shown on your map as:

5. Q(A) **Qualitative Auditory** (Sound) - Perceiving meaning through the sense of hearing. A major in this area probably distinguishes between sounds, tones of music and other purely sonic sensations. Sounds may interfere with (or help) concentration.
6. Q(O) **Qualitative Olfactory** (Smell) - Perceiving meaning through the sense of smell. Certain smells may interfere with the learning process to a person with a major.
7. Q(S) **Qualitative Savory** (Taste) - Perceiving meaning by the sense of taste. Majors usually smoke, chew gum, eat mints, or chew on pencils. They find tasting helps concentration.
8. Q(T) **Qualitative Tactile** (Touch) - Perceiving meaning by the sense of touch, temperature, and pain.
9. Q(V) **Qualitative Visual** (Sight) - Perceiving meaning through sight. Majors sometimes have trouble blocking out what they see.
10. Q(P) **Qualitative Proprioceptive** - Perceiving meaning through synthesizing or combining parts of a task, such as typewriting or playing a musical instrument.

The other qualities are social codes:

11. Q(CEM) **Qualitative Code Empathetic** - Sensitivity to the feelings of others; putting yourself in another person's place and seeing things from his or her point of view.

12. Q(CES) **Qualitative Code Esthetic** - Enjoying the beauty of an object or an idea. Beauty in surroundings or a well--turned phrase are appreciated by a person possessing a major in this area.

13. Q(CET) **Qualitative Code Ethic** - Commitment to a set of values, a group of principles, obligations and/or duties. This commitment need not imply morality. Both a priest and a criminal may be committed to a set of values although the "values" may be decidedly different.

14. Q(CH) **Qualitative Code Histrionic** - Exhibiting a deliberate behavior or "playing a role" to produce some particular effect on other persons. This type of person knows how to fulfill role expectations.

15. Q(CK) **Qualitative Code Kinesics** - Understanding and communicating by facial expressions and body motion such as smiles and gestures. Majors use their hands to talk.

16. Q(CKH) **Qualitative Code Kinesthetic** - Performing motor skills according to a recommended, or acceptable form, such as bowling or golfing "correctly".

17. Q(CP) **Qualitative Code Proxemics** - Judging the physical and social distance another person would permit. A major on this item knows how close to get and whom to call by first name.

18. Q(CS) **Qualitative Code Synnoetics** - Personal knowledge of oneself.

19. Q(CT) **Qualitative Code Transactional** - A major on this item is able to effectively put across an idea or to sell a product or influence another's behavior.

20. Q(CTM) **Qualitative Code Temporal** - A major on this item is aware of time and time expectations.

Review your map and see if these elements are appropriately placed for you.

Cultural Determinants

This second set, cultural determinants, shows which elements are chief influences on theoretical and qualitative symbols. Who helps to determine or influence your value judgments, decisions and actions? These scores will be found under "Cultural Determinants" on your map.

21. A **Associates** - The degree of influence by friends or persons other than family.

22. F **Family** - The influence that might include immediate family, business, church or authority figures.

23. I **Individual** - The degree of independence in evaluating information; a preference for dealing with new information on an individual basis.

Modalities of Inference

The third set, modalities of inference, shows patterns of thinking or how you make inferences. There are five different elements in this last set on your map.

24. M **Magnitude** - The degree to which an individual relies on and prefers a clear set of rules, classifications or definitions for accepting or rejecting an idea (categorical reasoning). Persons who need to define things or know the "policy", in order to understand, reflect this modality.

25. D **Difference** - The person who reasons in this pattern always looks for differences between and among concepts. There is a strong preference for contrasting one idea against another when learning new information. If two theories about the same topic were encountered, this student would want to know how they are different. Often artists possess this modality as do creative writers and musicians; however, this does not imply this is a requirement to being a good writer, artist or musician. People with a major here often say, "What if...".

26. R **Relationship** - This modality requires that things be seen in terms of how they are alike. One looks at a number of specific cases and attempts to explain them all with one general rule.

27. L **Appraisal** -- The modality of inference employed by an individual who uses all three of the modalities noted above (M, D and R) giving equal weight to each. A student strong in this element prefers to cover new material slowly and in detail, with a lot of opportunities to ask questions. As a result, these individuals may take a long time to make decisions.

28. (K) **Deductive** - Preference for solving problems in a stepwise fashion, reasoning from the general principle logically down to the specific case. Mathematical proofs and logical arguments are good examples of this type of information.

SUMMARY OF CSM SYMBOLS AND THEIR MEANINGS				YOUR MAP ANALYSIS					
	SYM. NO.	SYM.	MEANING (See text for more detailed explanation)	YOUR SCORE			Tend to Agree	Tend to Disagree	Undecided
				Major	Minor	Negligible			
THEORETICAL SYMBOLS	1.	T(AL)	Finding meaning through words you hear.						
	2.	T(AQ)	Finding meaning in spoken numbers or non-word symbols.						
	3.	T(VL)	Finding meaning from words you see or read.						
	4.	T(VQ)	Finding meaning in seeing numerical or non-word symbols.						
QUALITATIVE SYMBOLS	5.	Q(A)	Perceiving meaning through the sense of hearing. Distinguishing between sounds, music tones, etc.						
	6.	Q(O)	Perceiving meaning through the sense of smell. Odors may reinforce or interfere with learning process.						
	7.	Q(S)	Perceiving meaning through the sense of taste. Concentration may be aided by tasting, chewing gum, smoking, etc.						
	8.	Q(T)	Perceiving meaning through touch, temperature and pain.						
	9.	Q(V)	Perceiving meaning through sight.						
	10.	Q(P)	Perceiving meaning through synthesizing or combining parts of a task--like driving a car or playing a piano.						
	11.	Q(CEM)	Sensitivity to other's feelings. Putting yourself into another person's place.						
	12.	Q(CES)	Enjoying the beauty of an object, scene or idea.						
	13.	Q(CET)	Commitment to a set of values, principles, obligations and/or duties. (Does not imply morality.)						
	14.	Q(CH)	Exhibiting a deliberate behavior or "playing a role" to influence others.						

SUMMARY OF CSM SYMBOLS AND THEIR MEANINGS				YOUR MAP ANALYSIS					
				YOUR SCORE					
	SYM. NO.	SYM.	MEANING (See text for more detailed explanation)	Major	Minor	Negligible	Tend to Agree	Tend to Disagree	Undecided
QUALITATIVE SYMBOLS	15.	Q(CK)	Understanding and communicating by body motions, gestures, smiles, facial expressions, hands.						
	16.	Q(CKH)	Performing motor skills according to a recommended or acceptable form.						
	17.	Q(CP)	Judging the physical and social distance that another person would permit.						
	18.	Q(CS)	Personal knowledge of one's self.						
	19.	Q(CT)	Influencing another's behavior, effectively putting across an idea or selling a product.						
	20.	Q(CTM	Awareness of time and time expectations.						
CULTURAL DETERMINANTS	21.	A	Degree of influence by associates--persons other than family.						
	22.	F	Degree of influence by family, church, authority figures.						
	23.	I	Independence in evaluating information.						
MODALITIES OF INFERENCE	24.	M	Prefers a clear set of rules, classifications or definitions for accepting or rejecting an idea (categorical reasoning).						
	25.	D	Reasoning by looking for differences in concepts, such as in art, writing and music.						
	26.	R	Reasoning by looking for similarities in concepts (Inductive Reasoning).						
	27.	L	Reasoning by using the three previous modalities (M, D and R), giving equal weight to each.						
	28.	(K)	Reasoning from the general principle logically down to the specific case.						

RARELY	SOMETIMES	USUALLY	
			1
			2
			3
			4
			5
			6
			7
			8
			9
			10
			11
			12
			13
			14
			15
			16
			17
			18
			19
			20
			21
			22
			23
			24
			25
			26
			27
			28

Fold under to score.

RARELY X 1 SUB-TOTAL	SOMETIMES X 3 SUB-TOTAL	USUALLY X 5 SUB-TOTAL	SCORE	ITEM
				T(AL)1
				T(AQ)2
				T(VL)3
				T(VQ)4
				Q(A) 5
				Q(O) 6
				Q(S) 7
				Q(T) 8
				Q(V) 9
				Q(P)10
				Q(CEM)11
				Q(CES)12
				Q(CET)13
				Q(CH) 14
				Q(CK) 15
				Q(CKH)16
				Q(CP) 17
				Q(CS) 18
				Q(CT) 19
				Q(CTM)20
				A 21
				F 22
				I 23
				M 24
				D 25
				R 26
				L 27
				(K) 28

To Score - see directions on the back page of your booklet.

BLUEPRINT READING

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INTRODUCTION

In the Blueprint Reading module we will learn to read building and cartographic blueprints. We will put ourselves into a sample building and imagine the floor plan and interior spaces around us as we learn a process called visualization which is looking at two-dimensional plans and imagining the three-dimensional space. We will learn about the symbolic language and terminology of blueprints that tell us how the designer meant it to be built. The building plans included in the book will be used to construct a scale model. You will need to bring sturdy scissors or a mat knife to class. The maps will be used as we learn about cartography.

JOBS REQUIRING KNOWLEDGE OF BLUEPRINTS

BRICKLAYERS

CABINET MAKERS

CARPENTERS

CONSTRUCTION WORKERS

ELECTRICIANS

LINEPERSONS

GLAZIERS

MACHINISTS

PLASTERERS & DRYWALL INSTALLERS

STRUCTURAL METAL AND BOILER MAKERS

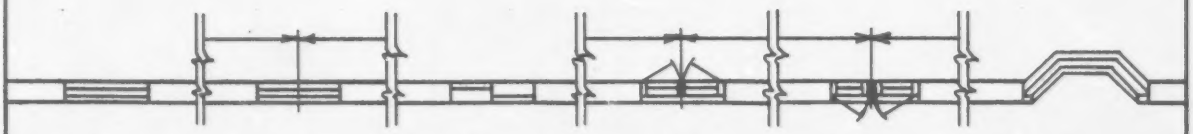
SHEET METAL WORKERS

PLUMBERS

WELDERS

BLUEPRINT SYMBOLS

WINDOWS



Standard | Double Hung | Horizontal Sliding | Double Casement | Mullion Casement | Bay

DOORS

Flush or Panel | Double-Hung | Bi-Fold | Pocket | Sliding

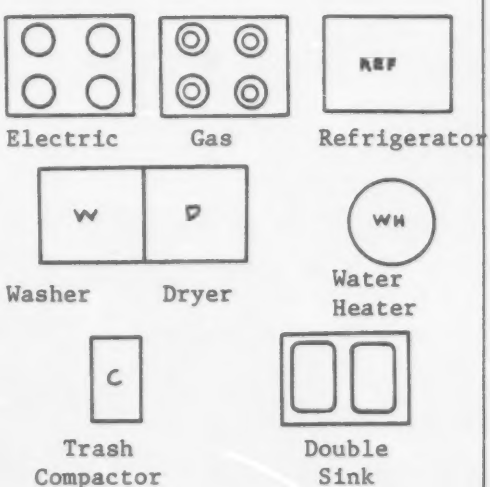
STAIRS

Straight | Spiral | Curved

FIREPLACES

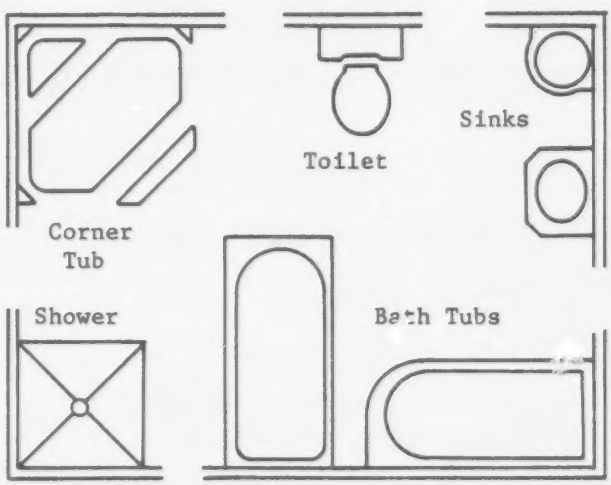
Basic | Freestanding

APPLIANCES



Electric | Gas | Refrigerator | Washer | Dryer | Water Heater | Trash Compactor | Double Sink

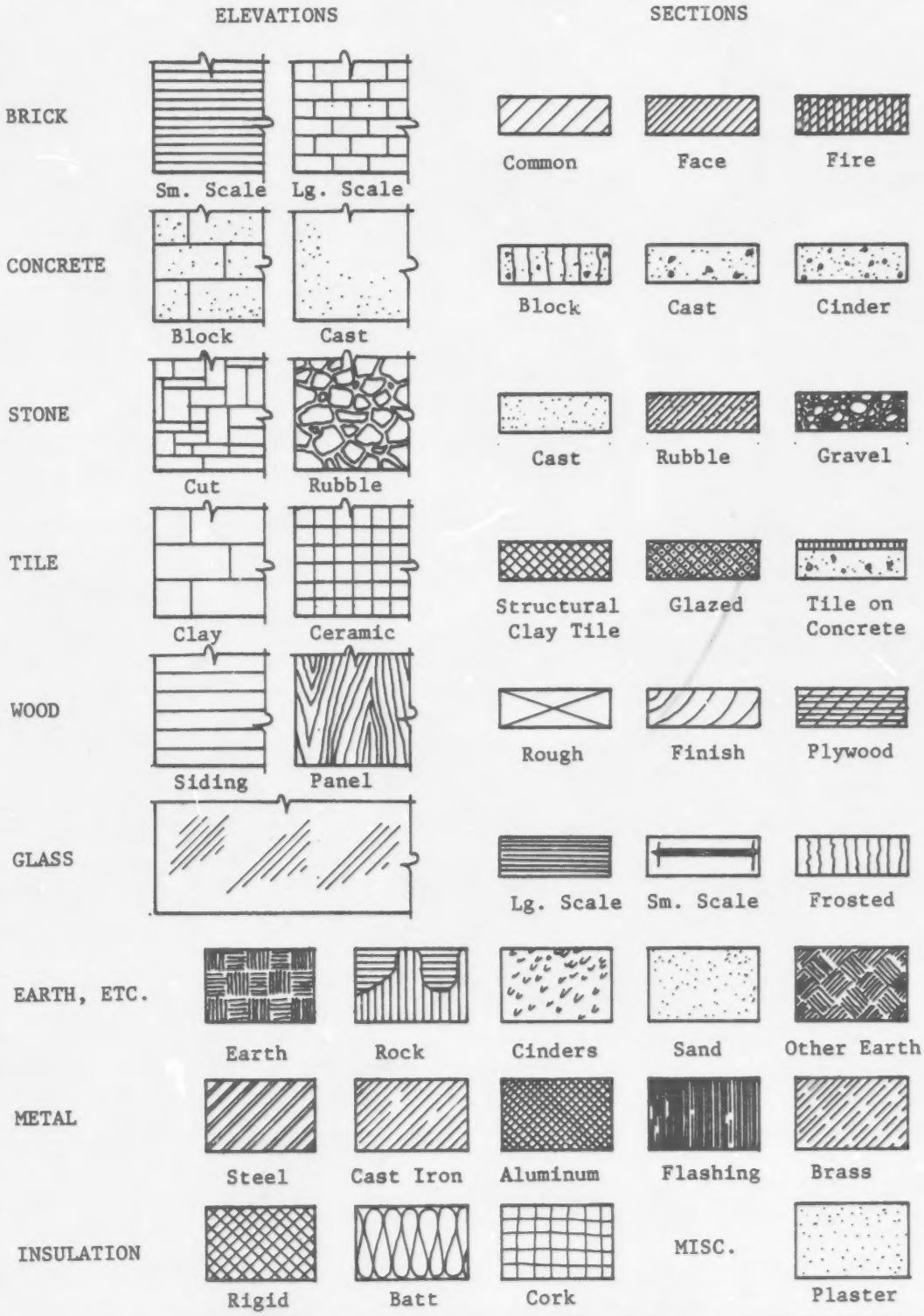
BATH FIXTURES



Corner Tub | Toilet | Sinks | Shower | Bath Tubs

83

CONSTRUCTION MATERIAL



ELECTRICAL SYMBOLS

RECEPTACLE OUTLETS

- Duplex
- Split wired duplex
- GFI Ground fault interrupter
- S Duplex with switch
- 220 220 Volt
- Special purpose
- Floor
- J Junction box

SWITCH OUTLETS

- S Single pole
- S_2 Double pole
- S_3 Three-way
- S_4 Four-way
- S_D Dimmer
- Push button

MISCELLANEOUS

Flush mounted Panel box

Meter

GENERAL OUTLETS

- Ceiling
- Recessed
- D Dropcord
- Wall
- L Lamp & pull switch
- Fluorescent
- Fan (Flush mount)
- Fan (Recessed)
- Fan-Light (Flush mount)
- Fan-Light (Recessed)

AUXILIARY

- Telephone
- Intercom
- Buzzer
- Bell
- CH. Chimes
- M Motor
- Television
- TV Telephone antenna
- T Thermostat

ELEVATION ABBREVIATIONS

Aluminum	AL
Asbestos	.ASB
Asphalt	ASPH
Basement	BSMT
Beveled	BLV or BEV
Brick	.BRK
Building	BLDG
Cast Iron	CI
Ceiling	.CLG
Cement	.CEM
Center	.CTR
Center Line	.c or CL
Clear	.CLR
Column	.COL
Concrete	CONC
Concrete Block	CONC BLK
Concrete Masonry Unit	.CMU
Copper	CPR or COP
Corner	.COR
Detail	DTL or DET
Diameter	DIAM or DIA or ϕ
Dimension	.DIM
Ditto	.DO.
Divided	.DIV
Door	DR
Double-Hung Window	.DHW
Down	.DN or D
Downspout	DS
Drawing	.DWG
Drip Cap	DC
Each	EA
East	.E
Elevation	EL
Entrance	.ENT
Excavate	.EXCA or EXC
Exterior	.EXT
Finish	FIN.
Fixed Window	FX WDW
Flashing	.FLG or FL
Floor	.FLR or FL
Foot or Feet	.' or FT
Footing	.FTG
Foundation	.FND
Full Size	FS
Galvanized	GV or GALV
Galvanized Iron	GI
Galvanized Steel	GS
Gage	GA
Glass	GL
Glass Block	GLB or GL BL
Grade	GD or GR
Grade Line	GL
Height	HT
High Point	H PT
Horizontal	.HOR
Hose Bibb	HB
Inch or Inches	" or IN.
Insulating (Insulated)	INS
Length	.L
Length Over All	.LOA
Level	.LEV
Light	LT
Line	.L
Lining	LN
Long	LG
Louver	.LVR or LV
Low Point	L PT or LP
Masonry Opening	MO
Metal	.MET. or M
Moulding	.MLD or MLDG
Mullion	MULL
North	.N
Number	NO. or #
Opening	.OPG or OPNG
Outlet	.OUT
Outside Diameter	OD
Overhead	OH or OVHD
Panel	.PNL
Perpendicular	PERP
Plate Glass	.PG or PL GL
Plate Height	.PL HT
Radius	RAD or R
Revision	.REV
Riser	.R
Roof	RF
Roof Drain	RD
Roofing	.RFG
Rough	.RGH
Saddle	SDL or S
Scale	SC
Schedule	.SCH
Section	.SEC or SECT
Sheathing	.SHTH or SHTHG
Sheet	.SHT or SH
Shiplap	SHLP
Siding	.SDG
South	.S
Specifications	SPEC
Square	SQ or
Square Inch	.SQ IN. or
Stainless Steel	.SST
Steel	.ST or STL
Stone	.STN
Terra Cotta	TC
Thick or Thickness	THK or T
Typical	.TYP
Vertical	VERT
Waterproofing	WP
West	.W
Width	W or WTH
Window	WIN or WDW
Wire Glass	WG or W GL
Wood	WD
Wrought Iron	WI

PLAN VIEW ABBREVIATIONS

Access Panel..... AP
Acoustic..... AC or ACST
Acoustical Tile.....ACT or AT
Adjustable.....ADJT or ADJ
Aggregate.....AGG or AGGR
Air Conditioning..... A/C or AIR COND
Aluminum.....AL
Anchor Bolt.....AB
Angle.....
Apartment.....APT
Approximate..... APX or APPROX
Architectural.....ARCH
Area.....A
Area Drain.....AD
Asbestos.....ASB
Asbestos Board.....AB
Asphalt.....ASPH
Asphalt Tile.....AT
Basement.....BSMT
Bathroom.....B
Bath Tub.....BT
Beam.....BM
Bearing Plate.....BPL or BRG PL
Bedroom.....BR
Blocking.....BLKG
Blueprint.....BP
Boiler.....BLR
Book Shelves.....BK SH
Brass.....BRS
Brick.....BRK
Bronze.....BRZ
Broom Closet.....BC
Building.....BLDG
Building Line.....BL
Cabinent.....CAB
Calking.....CK or CLKG
Casing.....CSG
Cast Iron.....CI
Cast Stone.....CST or CS
Catch Basin.....CB
Ceiling.....CLG
Cellar.....CEL
Cement.....CEM
Cement Asbestos Board..... CEM AB
Cement Floor.....CEM FL
Cement Mortar.....CEM MORT
Center.....CTR
Center to Center.....C to C
Center Line.....c or CL
Center Matched.....CM
Ceramic.....CER
Channel.....CHAN
Cinder Block.....CIN BL
Circuit Breaker.....CIR BKR
Cleancut.....CO
Clean out Door.....CODR
Clear Glass.....CL GL
Closet.....C, CL or CLOS
Cold Air.....CA
Collar Beam.....COL B
Concrete.....CONC
Concrete Block.....CONC BLK
Concrete Floor.....CONC FLR or CONC FL
Concrete Masonry Unit.....CMU
Conduit.....CND
Construction.....CONST
Contract.....CONTR or CONT
Copper.....CPR or COP
Counter.....CTR
Cubic Feet.....CFT or CU FT
Cut Out.....CO
Detail.....DTL or DET
Diagram.....DIAG
Dimension.....DIM
Dimmer.....DIM
Dining Room.....DR
Dishwasher.....DW
Ditto.....DO.
Double-Acting.....DA
Double Strength Glass.....DSG
Down.....DN or D
Downspout.....DS
Drain.....D or DR
Drawing.....DWG
Dressed and Matched.....D & M
Dryer.....D
Electric Metallic Tubing.....EMT
Electric Operator.....ELECT OPR
Electric Panel.....EP
End to End.....E to E
Excavate.....EXCA or EXC
Expansion Joint.....EXP JT
Exterior.....EXT
Exterior Grade.....EXT GR
Finish.....FIN.
Finished Floor.....FIN FLR or FIN. FL
Firebrick.....FBRK
Fireplace.....FPL or FP
Fireproof.....FP or FPRF
Fixed Window.....FX WDW
Fixture.....FIX.
Flashing.....FLG or FL
Floor.....FLR or FL
Floor Drain.....FD
Flooring.....FLR or FLG
Flourescent.....FLUR or FLUOR
Flush.....FL
Footing.....FTG
Foundation.....FND
Frame.....FR

Furring..... FUR
Galvanized Iron.....GI
Galvanized Steel.....GS
Garage.....GAR
Gas.....G
Glass.....GL
Glass Block.....GLB or GL BL
Grille.....G
Gypsum.....GYP
Gypsum Board.....GYP BD
Hardware.....HDW
Hollow Metal Door.....HMD
Hose Bibb.....HB
Hot Air.....HA
Hot Water.....HW
Hot Water Heater.....HWH
Inside Diameter.....ID
Insulation.....INS
Interior.....INT
Iron.....I
Jamb.....JB
Kitchen.....KIT or K
Landing.....LDG
Lath.....LTH
Laundry.....LAU
Laundry Tray.....LT
Lavatory.....LAV
Leader.....L
Length..... L, LG or LGTH
Library.....LIB
Light.....LT
Limestone.....LMS or LS
Linen Closet.....L CL
Lining.....LN
Linoleum.....LINO
Living Room.....LR
Louver.....LVR or LV
Main.....MN
Marble.....MRB or MR
Masonry Opening.....MO
Material.....MTL or MATL
Maximum.....MAX
Medicine Chest.....MC
Minimum.....MIN
Mixture.....MIX
Modular.....MOD
Mortar.....MOR
Moulding.....MLD or MLDG
Nosing.....NOS
Obscure Glass.....OBSC GL
On Center.....OC
Open Web Joist.....OJ or OW JOIST
Opening.....OPG or OPNG
Outlet.....OUT
Overall.....OA
Overhead.....OH or OVHD

.Pantry..... PAN.
Partition.....PTN
Per Square Inch.....PSI
Plaster.....PLAS or PL
Plastered Opening.....PO
Plate.....PL
Plate Glass.....PG or PL GL
Platform.....PLAT
Plumbing.....PLBG
Porch.....P
Precast.....PRCST
Prefabricated.....PFB or PREFAB
Pull Switch.....PS
Quarry Tile.....QT
Radiator.....RAD
Random.....RDM
Range.....R
Recessed.....REC
Refrigerator.....REF
Register.....REG
Reinforce.....RE or REINF
Revision.....REV
Riser.....R
Roof.....RF
Roof Drain.....RD
Room.....RM or R
Rough.....RGH
Rough Opening.....RO or RGH OPNG
S Beam.....S
Scale.....SC
Schedule.....SCH
Screen.....SCN or SCR
Section.....SEC or SECT
Service.....SERV
Sewer.....SEW.
Sheathing.....SHTH or SHTHG
Sheet.....SHT or SH
Shelving.....SH or SHELV
Shower.....SH
Sill Cock.....SC
Single Strength Glass.....SSG
Sink.....SK or S
Sliding Door.....SL DR
Soil Pipe.....SP
Specification.....SPEC
Square Feet.....SQ FT
Stained.....STN
Stairs.....ST
Stairway.....STWY
Standard.....STD
Steel.....ST or STL
Storage.....STO or STG
Switch.....SW or S
Telephone.....TEL
Tempered Plate Glass.....TEM PL GL
Terra Cotta.....TC

Thermostat.....THERMO
Threshold.....TH
Toilet.....T
Tongue and Groove.....T & G
Tread.....TR or T
Typical.....TYP
Unfinished.....UNF
Unexcavated.....UNEXC
Utility Room.....U RM
Vent.....V
Vent Stack.....VS
Vestibule.....VEST
Vinyl Tile.....VT or V TILE
Vitreous Tile.....VIT TILE

Wainscot.....WSCT or WAIN.
Warm Air.....WA
Washing Machine.....WM
Water.....W
Water Closet.....WC
Water Heater.....WH
Water Resistant.....WR
Waterproof.....WP
Weather Stripping.....WS
Weephole.....WH
Welded Wire Fabric.....WWF
Wide Flange.....W or WF
Wood.....WD
Wood Frame.....WF

CONSTRUCTION SCHEDULING

Power Pole
Water Meter
Lot Staked
Excavation
Loan Survey
Foundation Pour
Schedule Framing
Gravel Foundation
Deliver Post & Beam
Flatwork-Porches
Order Exterior
  Doors
  Windows
Order Tub
Order Appliances
Order Roof Trusses
Frame Post & Beam
Rough Plumb
Order Fireplace
Plumbing Inspection
Floor Insulation
Deliver
  Windows
  Frame lumber
  Tub
Frame
Deliver
  Fireplace
  Ext. Doors
Frame Inspection
Roof Load
Roofing
Plumbing Inspection
Rough Electrical
Garage Door
Gutters
Order
  Cabinets
  Finish Material
Electrical Inspection
Frame Inspection

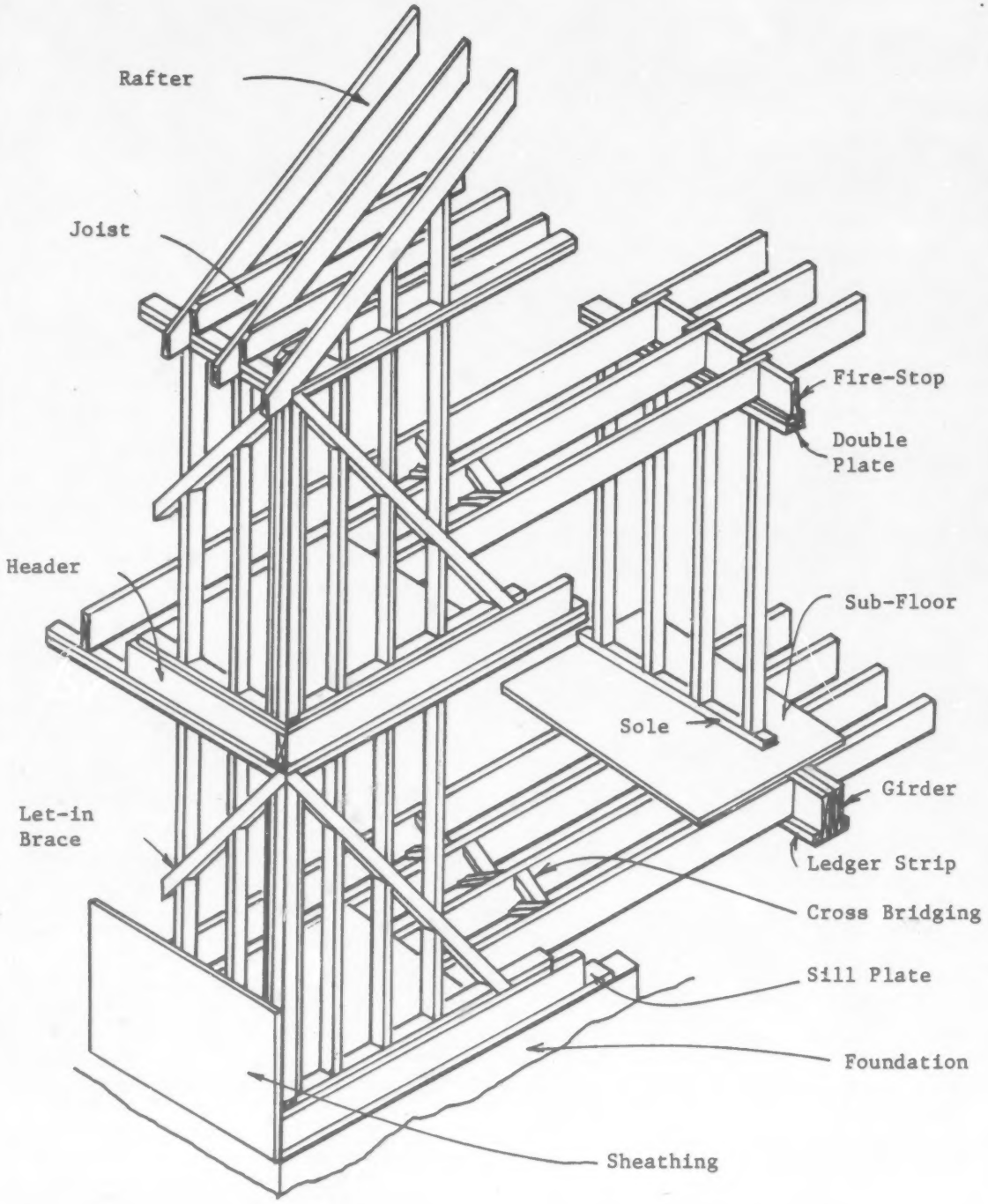
Exterior Paint
Permanent Power
Install Roof Drains
Backfill
Insulation
Lath Nailed*
Nail Inspection
Cable Heat
Thermostat Installed
Cable Inspection
Plaster*
Mason
Plaster Dry*
Paint
Deliver
  Chipboard
  Cabinets
  Finish Materials
Lock Up
Order Light Fixtures
Finish Work
Flatwork-Driveway
Blow Insulation
Stain and Varnish
Install Formica
Install Vinyl Floors
Deliver Appliances
Plumber Finish
Deliver Light Fixtures
Electrical Finish
Clean Up
Install Carpet
Finish Work
Touch Up Paint
Final Inspection
Final Plumbing Inspection
Final Electrical Inspection
Final Building Inspection
Final Clean Up
Loan Approval

*Install Drywall

*Tape Drywall

*Drywall Compound

CONSTRUCTION METHOD



NORTH DIRECTION

SHEET TITLE

SCALE DRAWN TO

DRAFTER'S NAME

DRAWINGS REVISED

DATE DRAWN

SEAL (architects, engineer, etc)

TITLE BLOCK

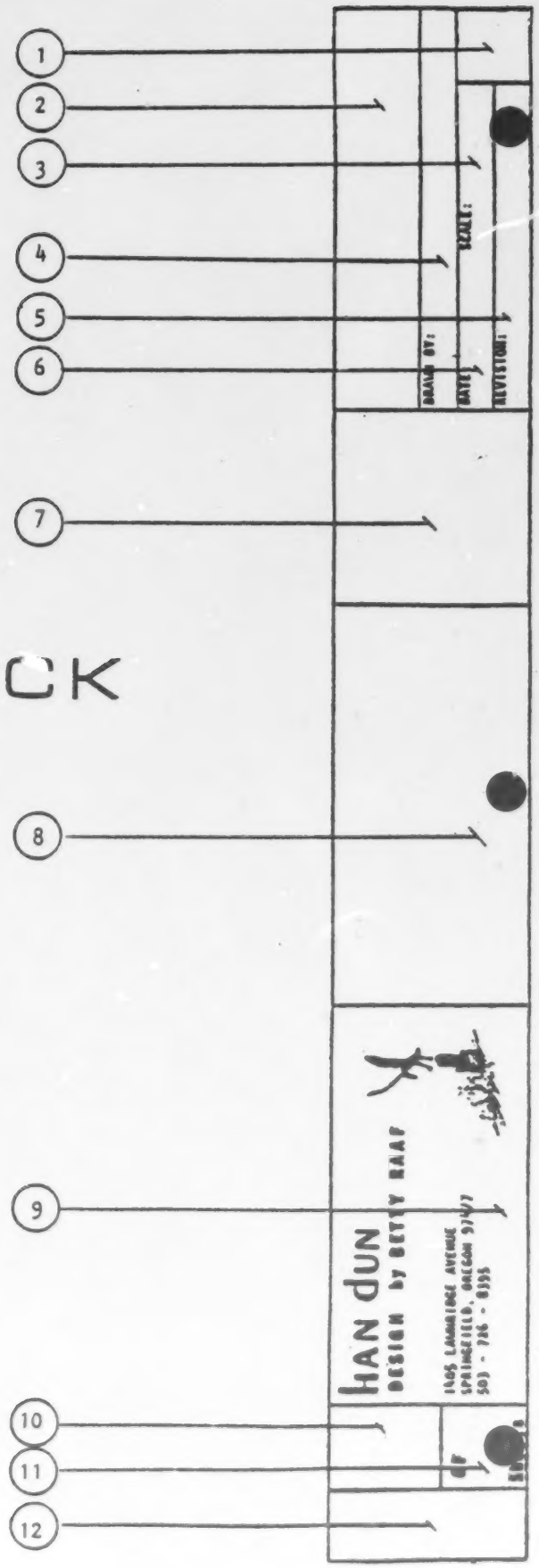
JOB LOCATION, CLIENT'S NAME
(may include legal
description also)

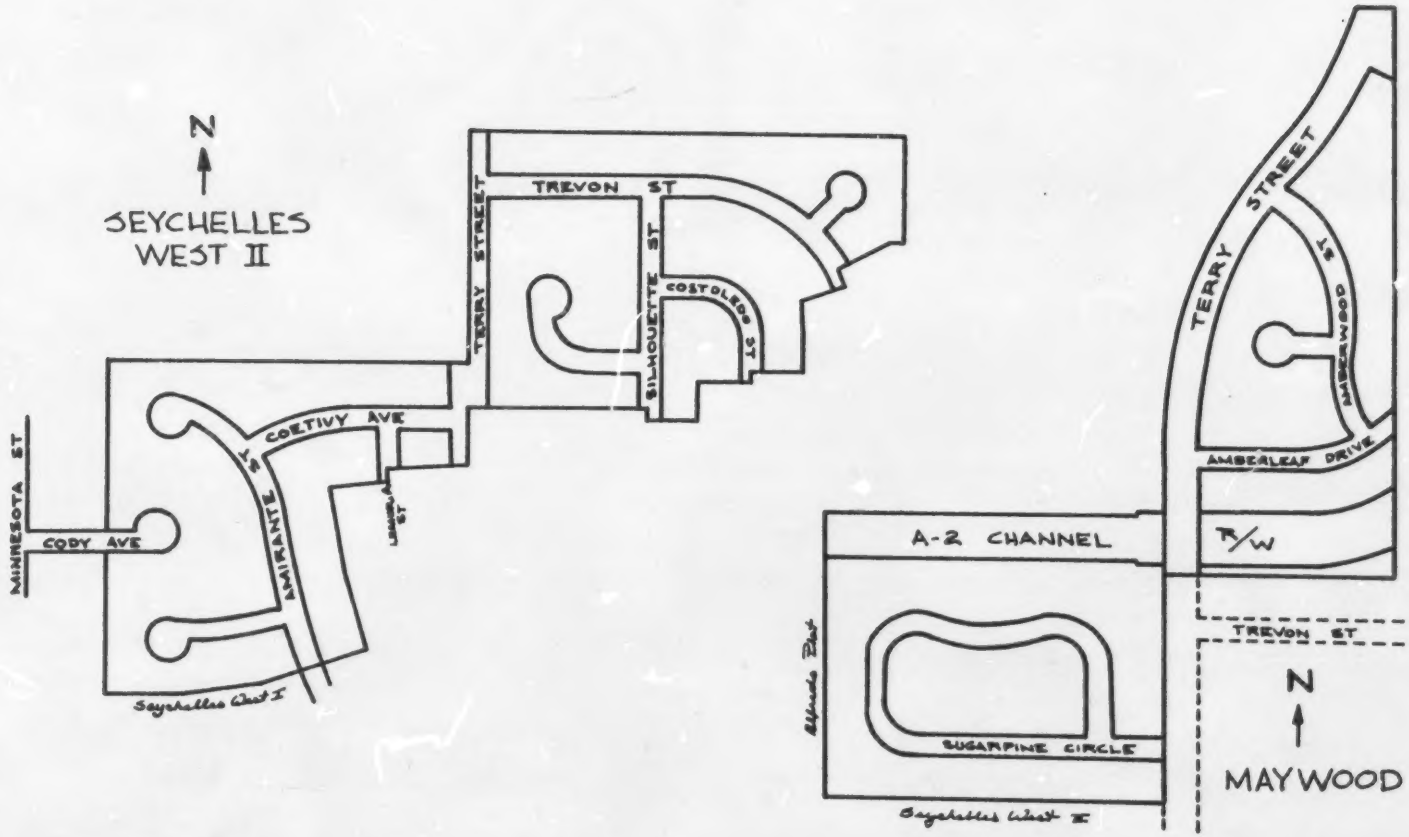
NAME, ADDRESS, PHONE OF
FIRMS PRODUCING DRAWINGS

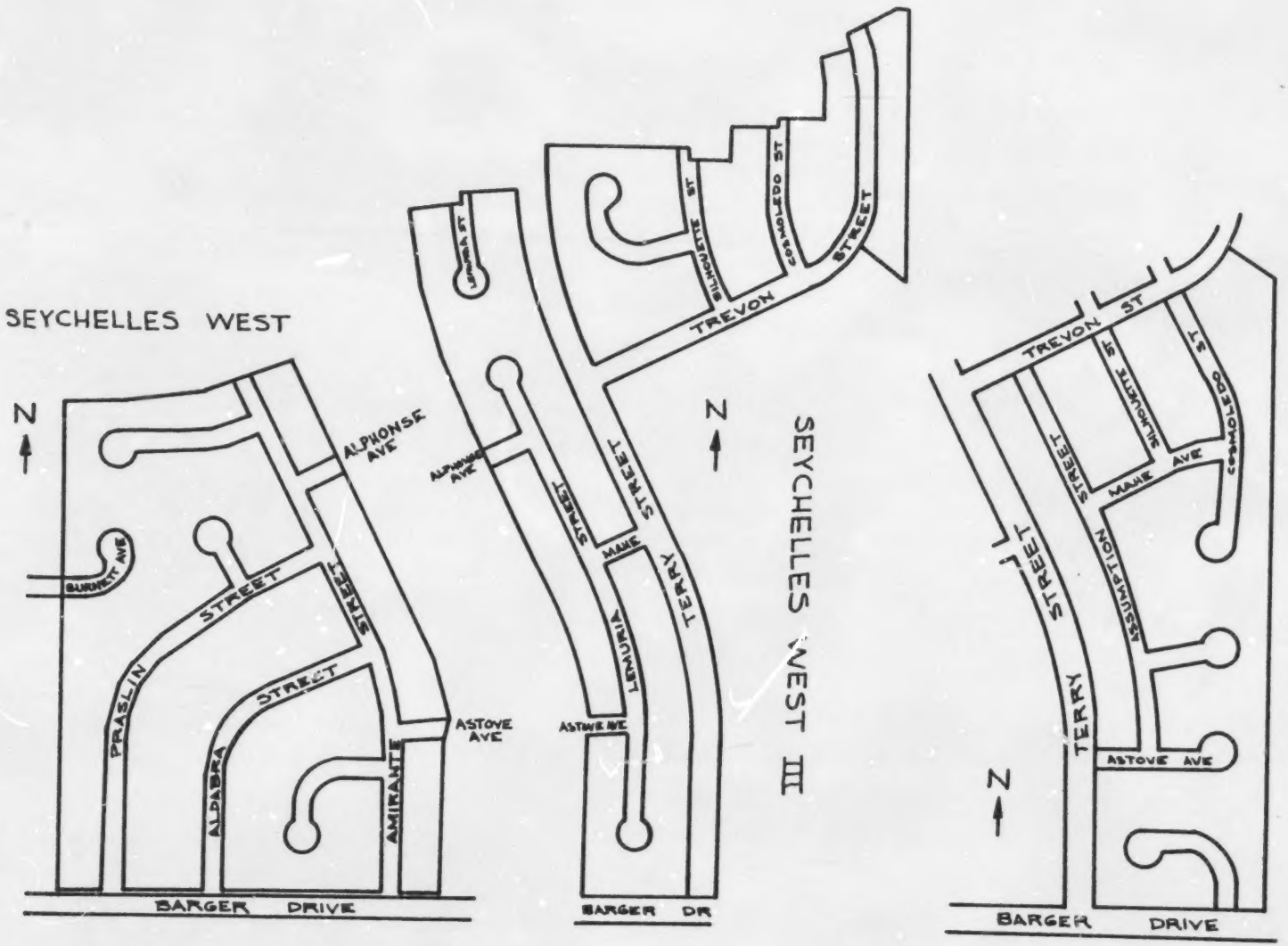
INDIVIDUAL SHEET NUMBER

TOTAL SHEETS TO SET OF PLANS

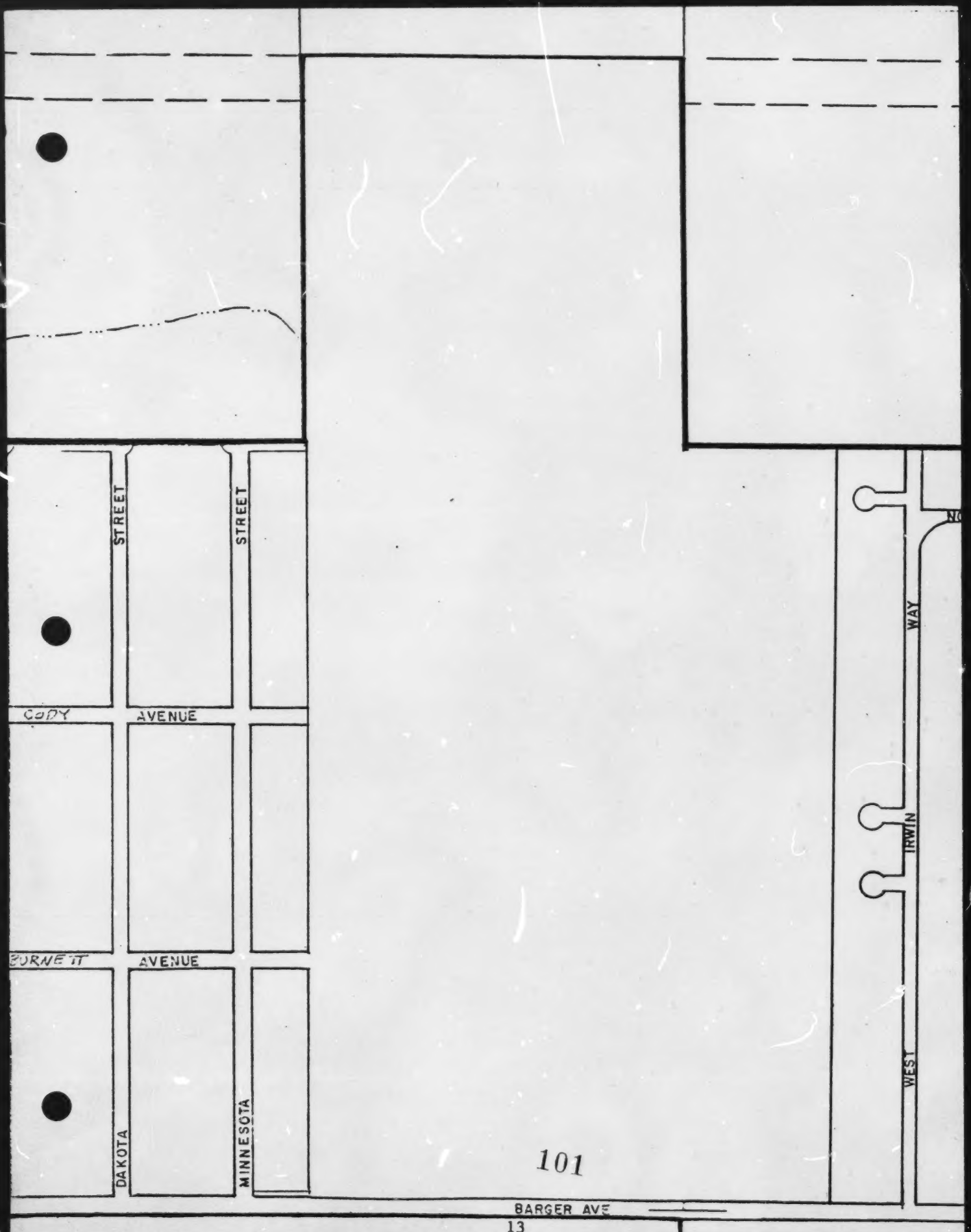
SPECIAL INDICATIONS




N
SEYCHELLES
WEST II
TREVON ST
TERRY STREET
SILHOUETTE ST
COSTOLERO ST
COETIVY AVE
MINNESOTA ST
CODY AVE
AMIRANTE ST
Seychelles West I
A-2 CHANNEL
R/W
AMBERLEAF DRIVE
AMBERWOOD ST
TREVON ST
SUGARPINE CIRCLE
Seychelles West II
N
MAYWOOD


SEYCHELLES WEST
N
ALPHONSE AVE
BURNETT AVE
PRASLIN STREET
STREET
ALDABRA STREET
AMIRANTE
ASTOVE AVE
BARGER DRIVE
ALPHONSE AVE
STREET
MAHE STREET
LEMURIA
ASTOVE AVE
TERRY
BARGER DR
TREVON STREET
SEYCHELLES WEST III
TREVON ST
STREET
MAHE AVE
ASSUMPTION
ASTOVE AVE
TERRY
BARGER DRIVE
SEYCHELLES WEST IV

12


STREET
STREET
COPY
AVENUE
BURNETT
AVENUE
DAKOTA
MINNESOTA
WAY
IRWIN
WEST
BARGER AVE
13

Stump
Arvard
Colin Kelly Sch
River Rd Sch
Danebo Sch
Bethel Sch
C & G S SOUTH BASE
RAILROAD
PACIFIC
SOUTHERN
Danebo
Cemetery
EUGENE
Oak Hill Sch
Bailey Sch
Murray Hill
BM 385
BM 404
BM 422
BM
Cem
17
16
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WOODSHOP

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INTRODUCTION

In the Woodshop module you will learn to use the equipment, understand the terminology, be introduced to the story rod, and practice using blueprints to build a woodshop project. Woodworking is a skilled craft that requires logical planning, precision and accuarcy. It is important to consider the the purpose of the component you cut or shape before you use the equipment; carelessness can mean ruined materials that must be replaced. It is also important to think before you move around the equipment in the woodshop; carelessness causes accidents.

RELATED JOBS

CABINET MAKER

FINISH CARPENTER

FURNITURE MAKER

BUILDING MATERIALS SALES

MILL WORKER

WELCOME TO LCC WOODSHOP

Please read this synopsis of the few rules we have in order to better serve you. Your cooperation is appreciated.

Do not hesitate to ask your instructor for assistance.

Remember: Three inches in all direction of any saw blade, jointer knives or shaper head, is the very minimum margin of safety.

The stock being cut to length on the radial arm saw must be flat on the table and back against the saw fence.

Never run a blind dado until you have been assured by the instructor that you are going to do it properly.

State law requires the use of all guards.

Remove the saw guards only when it is necessary and then be sure to replace them for the next person.

If you should have to run plywood across a jointer, please slide the jointer fence back to the farthest edge of the knives (away from you).

Parking by the shop area is allowed only while loading or unloading materials. (Parking fines are $2)

Be aware that loose clothing, jewelry and uncontrolled long hair are safety hazards; please do whatever to eliminate these hazards. We suggest you bring some type of ear protection.

We are not covered by any insurance carried by LCC. This is left up to each individual to provide their own if they so desire

WOODSHOP POLICY

In order for all students to more fully utilize the tools and equipment in the woodshop, the use of such tools and equipment will be restricted to a reasonable amount of time by each student.

The thickness planer is to be used for shop projects only and not to be used for quantities of materials to be used elsewhere. All materials must be removed from the shop by your last class period. Anything left will be disposed of.

You will need to bring in your own materials. No used or painted lumber or driftwood will be allowed to be processed through any of the machines. This is not a sawmill, so do not bring in unmilled wood. There are no machines or part of a machine that needs to be forced; let's solve the problem first. If you do not know, ask!

Have a safe and productive term.

POWER TOOL SAFETY

Understand the machine before you use it. Know where the on/off switch is.

Use all guards available to you.

Do not wear loose fitting clothing. Tie hair back. Do not wear sandals.

Keep fingers at least 6" from cutting edges.

Keep floors around the machines clean. Always stand in a well balanced position.

Make all adjustments with the power off.

Keep all blades sharp.

PNEUMATIC TOOL SAFETY

No horseplay! Never point air guns at others.

Unplug tool when loading or adjusting it.

Make sure all the safety guards work.

Only fire into the material to be fastened, not into the air. The tool is not designed for that purpose.

Staple with the grain.

TABLE SAW

Set up:

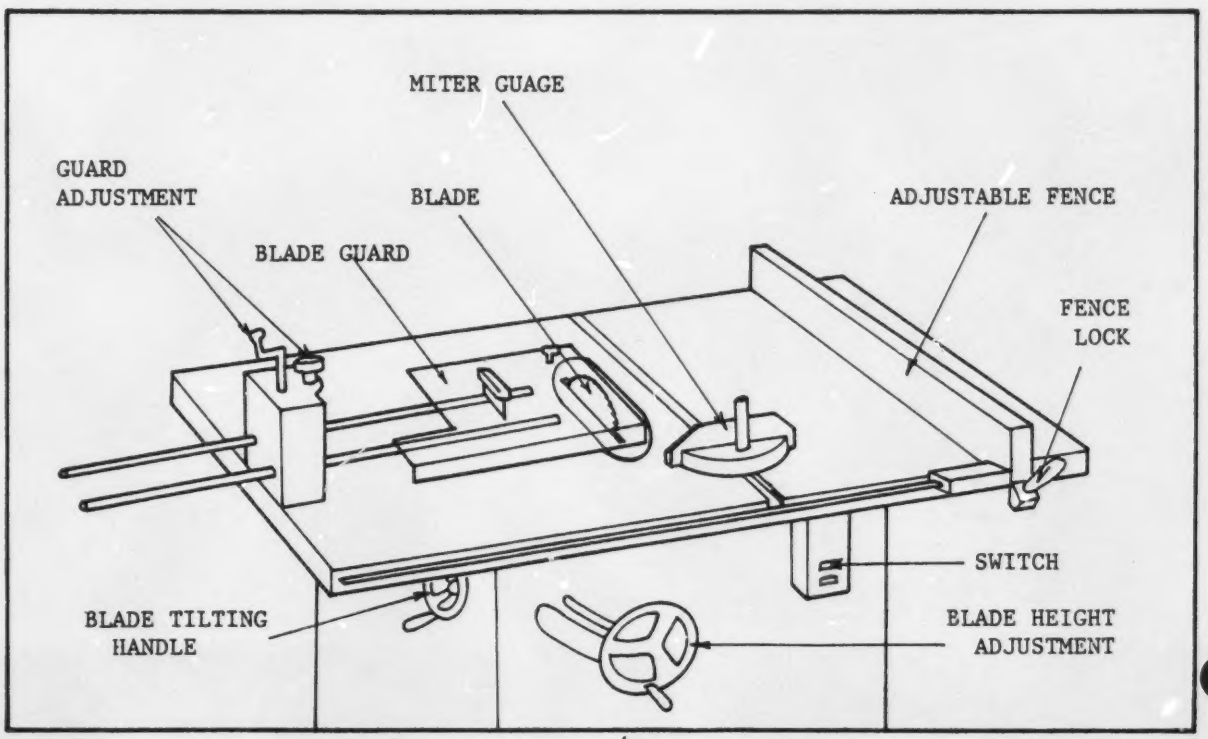
1. Make sure all adjustments are made snugly and the guards are in place.
2. Stand a bit to the left side of the blade.
3. Stock should be ready for the cut, with one edge straight. Have a push stick available if necessary.

Procedure:

1. Turn on the saw.
2. Push the stock forward into the blade, holding it flat against the table and the fence all the way throught the cut. The wood between the blade and the fence is the piece that can bind and kick back if not held straight and securely.
3. Continue feeding stock until it is completely past the blade.
4. If the board to be cut is narrower than 6", use a push stick.
5. If the stock is very long (as with plywood), have a helper off-feed, standing behind the saw to support the piece after it passes the blade.
6. Turn the saw off after a cut. Lower the blade when finished using the saw.

Remember:

1. Keep fingers away from the saw blade.
2. Adjust saw to protrude only 1/4" above stock.
3. Never reach over, or in front of, the moving saw blade.



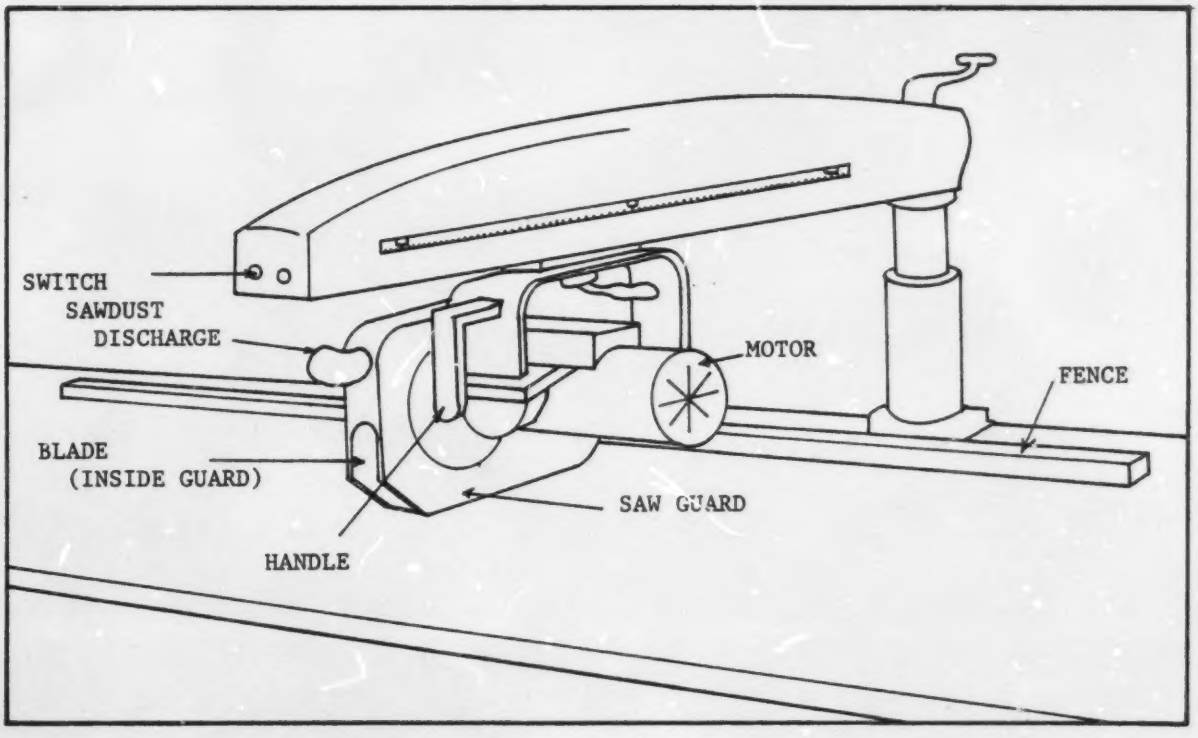
RADIAL ARM SAW

Set-up:

1. Be sure fence and stop block are secure and all guards are in place.
2. Saw should be at the rear of the table, behind the saw guide.
3. Keep hands out of line of travel of saw blade.

Procedure:

1. Hold stock firmly against fence between stop and cut to be made.
2. Turn on the saw and allow it to come to full speed.
3. Pull saw forward slowly and evenly until cut is complete. Cut is made on the forward stroke.
4. Do not let go of stock until saw blade has returned past the guide fence.
5. Turn off the saw,



JOINTER

Set up:

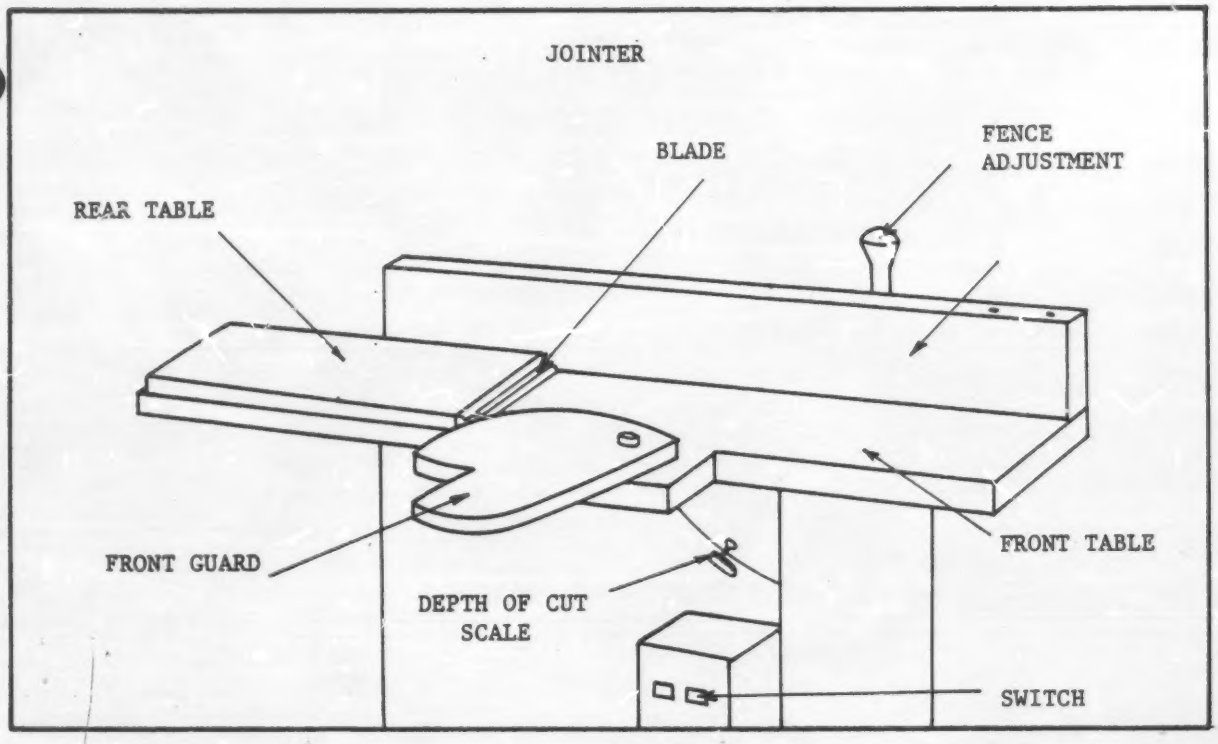
1. Make adjustments while jointer is off, adjusting for a light cut, 1/16" to 1/8". Make sure the fence is secure and the guard is working and in place.
2. Check board for warp and grain direction.
3. Stand to the side of jointer, not directly behind it.

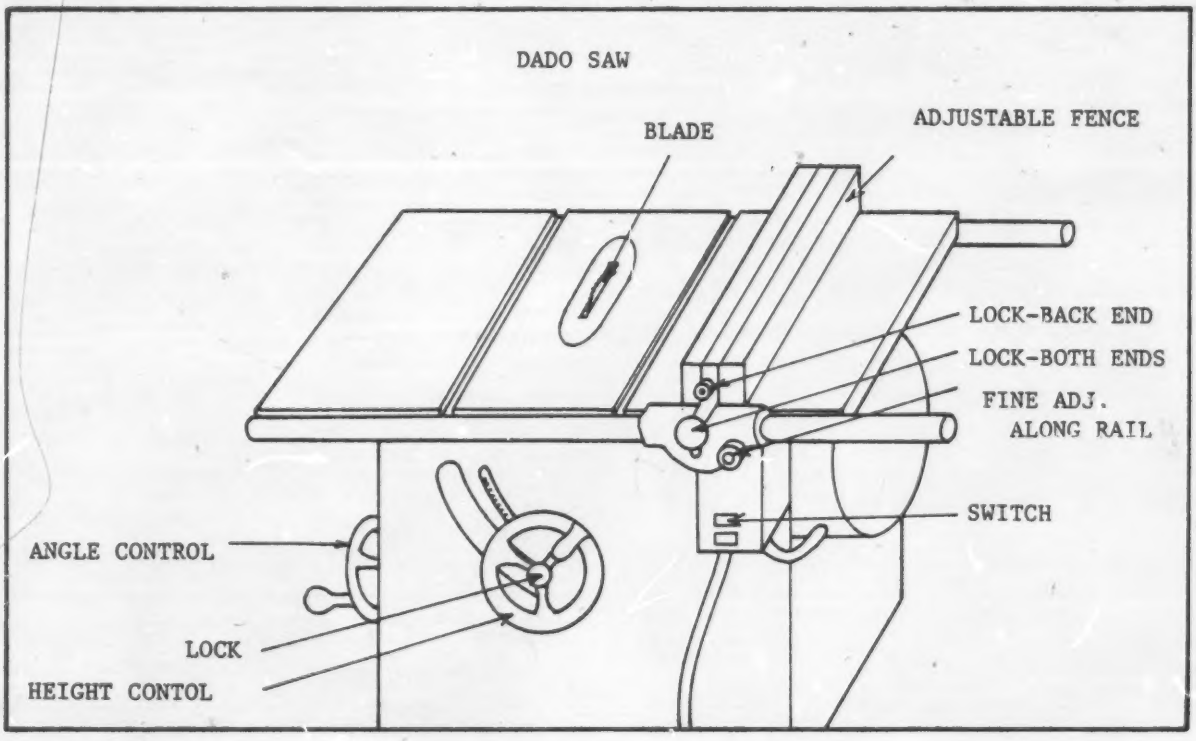
Procedure:

1. Hold board firmly on infeed table with left hand at least 4" from the front of the board, and the right hand to the rear.
2. Turn on saw and allow it to come to full speed.
3. Apply equal pressure downward with both hands. Keep board squarely against the fence.
4. Move stock forward, keeping left hand back of cutting knives.
5. When 1/2 to 2/3 of the board has passed the blades, keep left hand on the board over outfeed table.
6. As board is nearly over cutter, move right hand over outfeed table to complete the cut.
5. Turn off jointer.

Remember:

1. Use a push-stick if board is less than 3" thick.
2. Never push a board past the cutting blade with right hand cupped over end of stock as it could fall into blades. Never pass hands over the knives.
3. Do not joint stock less than 12" long. Stock should be at least 1/2" thick and 3/4" wide.


JOINTER
BLADE
FENCE ADJUSTMENT
REAR TABLE
FRONT GUARD
DEPTH OF CUT SCALE
FRONT TABLE
SWITCH


DADO SAW
BLADE
ADJUSTABLE FENCE
LOCK-BACK END
LOCK-BOTH ENDS
FINE ADJ. ALONG RAIL
SWITCH
ANGLE CONTROL
LOCK
HEIGHT CONTOL

DADO SAW

To make a dado or rabbet cut, the table saw must be set up with the dado saw blades. The dado head usually includes 2 full round saw blades (one with the teeth tilted to the left, the teeth of the other to the right) and a group of chippers , varying in thickness from 1/16" to 1/4".

Set up:

1. Make sure that the power is off.
2. Take out the blade insert.
3. With two wrenches, loosen the nut on the arbor that holds the blade tight. (This is a backwards thread.)
4. Take the blade off and replace with the required set of dado blades.

   The two saw blades you must use measure 1/4". Place the one with the teeth angled to the left on first. The teeth should be turning towards the front of the saw.

   Select the chippers that when added to the 1/4" thickness of the saw blades will total the thickness of the cut you need. Place the chippers on the arbor, with the teeth turning towards the front of the saw. The teeth of the chippers fit between the teeth of the outside blade. Make sure that the ends of the chippers are staggered evenly so that the tips do not touch. Place the right hand outside saw blade on the machine, making sure that the teeth turn forward.
5. Tighten the nut on the arbor, using both wrenches. (This is a backwards nut. It tightens against the forward motion of the saw blade.)
6. Measure the depth of your cut and the fence adjustment. Make sure all adjustments are accurate and snug. For a rabbet cut, the fence should be right next to, but not touching, the right hand side of the dado set-up. Make sure that there is a wooden face on the fence.

Procedure:

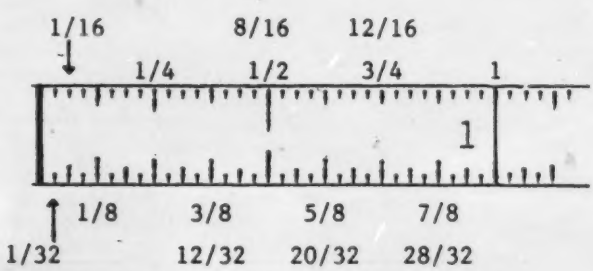
1. Follow the same procedures listed with the table saw. (Page 4)
2. The dado saw removes a lot of wood with one cut. Be sure to pass the stock over the blades slowly and evenly.

Remember:

1. Use a push stick if your work is narrow.
2. Use the miter gauge to keep the work square to the fence if the work is longer than it is deep.
3. Do not lay blades or chippers directly on metal tables. The carbide tips could be chipped if they are misused. Handle them carefully.
4. Be aware of the location of the saw blades. You cannot see them as you pass your work over the set up, so be careful of your fingers. Keep your fingers out of the path of the blades as you finish the cut.

MEASURING

Cabinetmakers usually use a 12' or 20' tape measure. They must work with accurate measurements. Tolerances of 1/16" or 1/32" or smaller are used. Each inch on the tape measure is divided into 1/16 increments; the first 12 inches is also divided into 1/32 increments. Learn to read your tape measure and the simple fractional equivalents.



STORY ROD

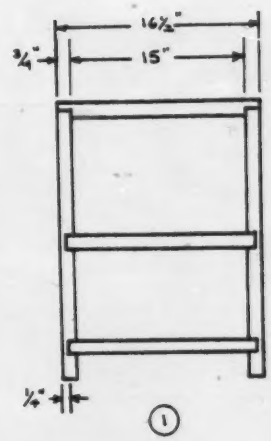
There are several methods to lay out the dimensions of a cabinet from plans. The story rod provides a readily visible. life-size scale of the length depth, and height of a cabinet. You will become familiar with the plans while marking the rod, and once it is completed, you will not need to refer to the plans again. You will use the rod to make up your cutting list and to check your work.

The rod is marked with the appropriate dimensions of the lumber and plywood to be used, and the locations of all rabbets and dados in a 1:1 scale. Use a scrap piece of plywood at least as long as the longest dimension of your cabinet.

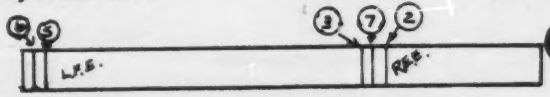
One side of the rod will contain information about the front layout (location of wall and finished ends, depth of dados, drawer and door openings). Another side represents the depth of the cabinet (with information on face frames, backs, nailer and toe kick). The third side includes overall height, location of face frames, dados, shelves, and toe kick.

HOW TO MEASURE LENGTH ON STORY ROD

1. The draft of your cabinet looks like this.



2. Mark one side "front." Start from the left; measure overall length (16 1/2") onto story rod. Mark R.F.E for "right finished end." Mark out left over rod.
3. Mark 3/4" from R.F.E into left for thickness of the plywood side.
4. Label left end L.F.E. for "left finished end."
5. Mark 3/4" from L.F.E. to right for thickness of the plywood side.
6. From measurement #5, mark 1/4: to left, in red, for dado (for shelves). This leaves 1/2" of plywood from left end to dado cut.
7. From measurement #2 mark 1/4" to right, in red, for dado (for shelves). This leaves 1/2" of plywood from right end to dado cut.
8. Measure between #5 and #3. Is it 15"?



NIGHTSTAND

	NAME OF PART	T	W	L	MATERIAL
CASE	Left end				
	Right end				
	Top				
	Bottom				
	Shelf				
	Back				
DRAWER	Left side				
	Right side				
	Front				
	Back				
	Bottom				
	Runners (2)				
	Facing strips (5)				

PROCEDURES

(1) Case:
- A. Cut plywood parts
- B. Machine parts
- C. Cut runner
- D. Assemble case

(2) Drawer:
- A. Cut parts to length; rip to width
- B. Machine parts
- C. Assemble drawer; test fit

(3) Finishing:
- A. Cut and attach facings
- B. Putty, sand and stain

ASSEMBLY PROCEDURE

CASE PARTS 3/4" plywood. 4 nightstands per 4' x 8' sheet of plywood.

Cutting (Label all parts)

1. Rough crosscut at 48".
2. Crosscut at 23 1/2", cut 2x for ends, 1/2 of sheets.
3. Crosscut at 16 1/2", cut 1x for top, 1 cut per sheet.
4. Crosscut at 15 1/2", cut 2x for shelves, 2 cuts per sheet.
5. Rip at 11 3/4" for end and top peices.
6. Rip at 11 1/2" for shelves.

Machining

1. 3/4" x 1/2: rabbet, top and both sides.
2. 3/4" x 1/4" dado, sides, 2" from bottom to top of dado.
3. 3/4" x 1/4" dado, sides, 13" from bottom to top of dado.
4. 1/4" x 1/4" rabbet, top and ends, inside back.

BACKS 1/4" plywood. 12 backs per 4' x 8' sheet of plywood.

1. Rough cross cut at 48"
2. Cross cut at 22".
3. Rip at 15 1/2".

DRAWER

1. 1/2" x 1/4" rabbet, front, both ends.
2. 1/4" x 1/4" dado, 1/2" from bottom to top of dado front and sides, inside.
3. 13/16" x 1/4" rabbet, 2" from bottom to top of dado sides, outside.

ELECTRONICS

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RESISTER CODES	8
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INTRODUCTION

The Electronics module will introduce the electrical concepts and terminology that are the basic foundation for both electronics and electricians occupations. Our class projects will give you practice using electronic components and equipment, making simple electrical repairs, making a circuit tester, and doing household wiring.

RELATED JOBS

APPLIANCE-REFRIGERATION TECHNICIAN

COMMUNICATIONS ENGINEERING TECHNICIANS

ELECTRONICS ASSEMBLERS

ELECTRONICS TECHNICIANS

ELECTRONICS ENGINEERING TECHNICIANS

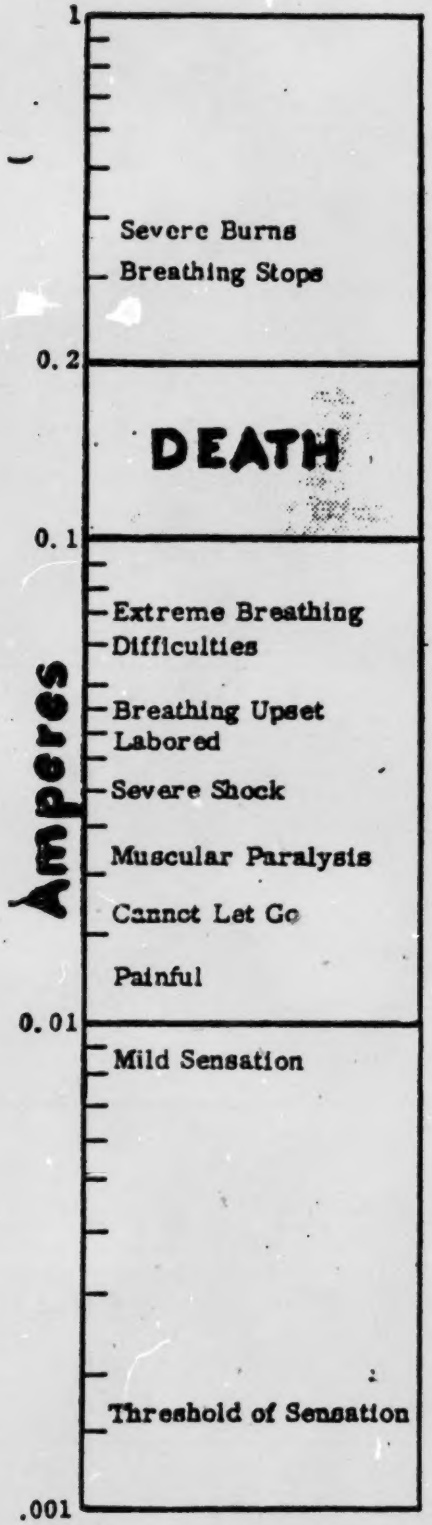
ELECTRICAL ENGINEERS

ELECTRIC MOTOR WINDERS

ELECTRICIANS
construction
inside
maintenance
manufacturing plant
railroad

TELEVISION-CABLE LINEPERSON

UTILITY ELECTRICAL WORKER



Physiological Effects of Electric Currents

The Fatal Current

Strange as it may seem, most fatal electric shocks happen to people who should know better. Here are some electro-medical facts that should make you think twice before taking that last chance.

It's the Current That Kills

Offhand it would seem that a shock of 10,000 volts would be more deadly than 100 volts. But this is not so. Individuals have been electrocuted by appliances using ordinary house currents of 110 volts and by electrical apparatus in industry using as little as 42 volts direct current. The real measure of a shock's intensity lies in the amount of current (amperes) forced through the body, and not the voltage. Any electrical device used on a house wiring circuit can, under certain conditions, transmit a fatal current.

While any amount of current over 10 milliamps (0.01 amp) is capable of producing painful to severe shock, currents between 100 and 200 ma (0.1 to 0.2 amp) are absolutely lethal. There is no known medical procedure that will revive the victim.

Currents above 200 milliamps (0.2 amp), while producing severe burns and unconsciousness, do not usually cause death if the victim is given immediate attention. Resuscitation, consisting of artificial respiration, will usually revive the victim.

From a practical viewpoint, after a person is knocked out by an electric shock it is impossible to tell how much current passed through the vital organs of his body. Artificial respiration must be applied immediately if breathing has stopped.

The Physiological Effects of Electric Shock

The chart on this page shows the physiological effects of various current densities. Note that voltage is not a consideration. Although it takes a voltage to make the current flow, the amount of shock-current will vary, depending on the body resistance between the points of contact.

As shown in the chart, shock is relatively more severe as the current rises. At values as low as 20 milliamps, breathing becomes labored, finally ceasing completely even at values below 75 milliamps.

As the current approaches 100 milliamps, ventricular fibrillation of the heart occurs—an uncoordinated twitching of the walls of the heart's ventricles. There's no worldly help for the victim.

Above 200 milliamps, muscular contractions are so severe that the heart is forcibly clamped during the shock. This clamping protects the heart from going into ventricular fibrillation, and the victim's chances for survival are good.

Danger—Low Voltage!

It is common knowledge that the victims of high-voltage shock usually respond to artificial respiration more readily than the victims of low-voltage shock. The reason may be the merciful clamping of the heart, owing to the high current densities associated with high voltages. However, lest these details be misinterpreted, the only reasonable conclusion that can be drawn is that 75 volts are just as lethal as 750 volts.

The actual resistance of the body varies depending upon the points of contact and the skin condition (moist or dry). Between the ears, for example, the internal resistance (less than skin resistance) is only 100 ohms, while from hand to foot it's closer to 500 ohms. The skin resistance may vary from 1000 ohms for wet skin to over 500,000 ohms for dry skin.

When working around electrical equipment, move slowly. Make sure your feet are firmly placed for good balance. Don't lunge after falling tools. Kill all power, and ground all high-voltage points before touching wiring. Make sure that power cannot be accidentally restored. Do not work on ungrounded equipment.

Don't examine live equipment when mentally or physically fatigued. Keep one hand in pocket while investigating live electrical equipment. Above all, do not touch electrical equipment while standing on metal floors, damp concrete or other well-grounded surfaces. Do not handle electrical equipment while wearing damp clothing (particularly wet shoes) or while skin surfaces are damp.

Do not work alone! Remember the more you know about electrical equipment, the more heedless you're apt to become. Don't take unnecessary risks.

What To Do for Victims

Cut voltage and/or remove victim from contact as quickly as possible—but without endangering your own safety. Use a length of dry wood, rope, blanket, etc., to pry or pull the victim loose. Don't waste valuable time looking for the power switch. The resistance of the victim's contact decreases with time. The fatal 100 to 200-milliampere level may be reached if action is delayed.

If the victim is unconscious and has stopped breathing, start artificial respiration at once. Do not stop resuscitation until medical authority pronounces the victim beyond help. It may take as long as eight hours to revive the patient. There may be no pulse and a condition similar to rigor mortis may be present; however, these are the manifestations of shock and are not an indication that the victim has succumbed. —*Printed through the Courtesy of Fluid Controls Company, Inc., Cliffside, New Jersey and University of California Information Exchange Bulletin.*

Electricity Kills

Reprint from
SAFER OREGON

2 State Industrial Accident Commission
Accident Prevention Division
Special Services Section

FACTS ON ELECTRICAL SHOCK

The resistance of the human body to electrical current depends on the skin condition and point of contact.*

TYPES OF RESISTANCE	RESISTANCE VALUES
Dry skin	100,000 to 600,000 Ohms
Wet skin	1,000 Ohms
Internal body	
Hand to foot	400 to 600 Ohms
Ear to ear	100 Ohms

With 120 Volts and a skin resistance plus internal resistance totaling 1200 Ohms, there would be 1/10 amperes (100 milliamperes) of electrical current. Skin resistance gradually decreases during prolonged contact.

SAFE CURRENT VALUES	Causes no sensation	1 milliamperes
	Sensation of shock but not felt, person can let go since muscle control is not lost.	1 to 8 milliamperes
UNSAFE CURRENT	Painful shock, person can let go since muscle control is not lost.	8 to 15 milliamperes
	Painful shock, muscle control lost in adjacent muscles, cannot let go.	15 to 20 milliamperes
	Painful, severe muscle contractions, difficult breathing.	20 to 50 milliamperes
	VENTRICULAR FIBRILLATION Instant death with no known remedy.	100 to 200 milliamperes
	Severe burns, severe muscle contractions that cause muscles to clamp heart and stop it during the shock. This prevents ventricular fibrillation.	200 or more milliamperes

*American Red Cross figures

Current is the killing factor in electrical shock. Voltage determines how much current will flow through a given resistance. Voltage as low as 25 volts can cause death; voltage over 1000 volts may not be as dangerous as a low voltage.

NAME_____

ELECTRICAL SHOCK

Place nearest correct answer in left margin:

____ 1. Which one of the following is regarded as the most damaging to life?

1. Voltage
2. Current
3. Resistance
4. Wattage

____2. Which of the following amounts of current is the most dangerous to life.

1. .001 Amps
2. .01 Amps
3. .15 Amps
4. .35 Amps
5. .45 Amps

____3.& 4. The electrical resistance of the body depends upon 2 answers.

____

1. Points of contact
2. Skin condition (moist or dry).
3. Weight
4. Height
5. Age
6. Health condition
7. Time of day
8. Season

_____5. When working around electrical equipment

1. make sure equipment is grounded.
2. move slowly.
3. maintain good balance.
4. don't stand on metal or concrete floors.
5. None of above.
6. All of above.

____6. A typical resistance of dry skin is about.

1. 10 ohms
2. 100 ohms
3. 1,000 ohms
4. 10,000 ohms
5. 100,000 ohms

____7. A typical resistance of wet skin is about
(Use answers in Question 6.)

____8. A typical resistance (internal body) from ear-to-ear is about
(use answers in Question 6.)

____9. One milliamper is

1. 1/10 of an amp (.1).
2. 1/100 of an amp (.01).
3. 1/1,000 of an amp (.001).
4. 1/10,000 of an amp (.0001).
5. 1/100,000 of an amp (.00001).

____10. What is the meaning of the expression "keep one hand in pocket while investigating live electrical equipment?"

LANE COMMUNITY COLLEGE
ELECTRONICS DEPARTMENT

INTRODUCTION TO ELECTRONICS..
(Exercise 2)

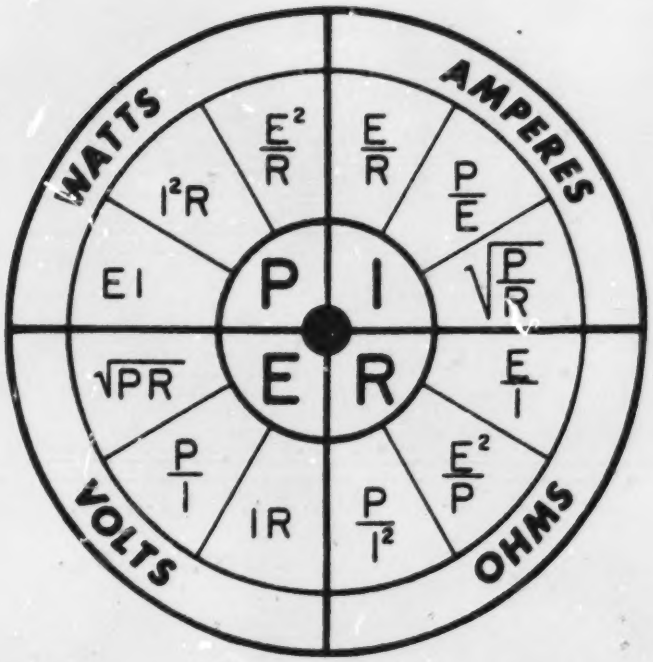
NAME_____

IDENTIFICATION OF PARTS

Number	Name	Symbol
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

COMMONLY USED

ELECTRICITY AND ELECTRONIC DATA



Ohms Law
Calculator

CIRCUIT FORMULAS

← SERIES PARALLEL →

RESISTANCE - OHMS

$$R_T = R_1 + R_2 + R_3 + \cdots \text{ETC.}$$

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \text{ETC.}}$$

$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

CAPACITANCE-FARADS

$$C_T = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \cdots \text{ETC.}}$$

$$C_T = C_1 + C_2 + C_3 + \cdots \text{ETC.}$$

$$C_T = \frac{C_1 C_2}{C_1 + C_2}$$

INDUCTANCE-HENRYS

$$L_T = L_1 + L_2 + L_3 + \cdots \text{ETC.}$$

$$L_T = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \cdots \text{ETC}}$$

$$L_T = \frac{L_1 L_2}{L_1 + L_2}$$

TUBE SYMBOLS

DIODE

TRIODE

TETRODE

PENTODE

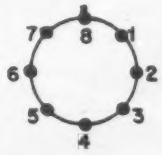
BEAM POWER

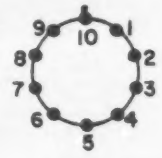
PENTAGRID CONVTR.

SOLID STATE

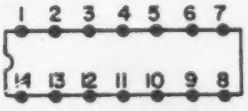
INTEGRATED CIRCUITS

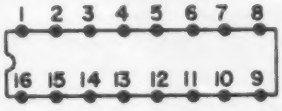
(BOTTOM VIEWS)

8-PIN  MODIFIED TO-5

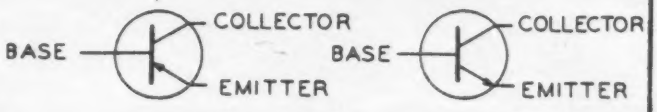
10-PIN  MODIFIED TO-5

12-PIN MODIFIED TO-5

14-PIN  DUAL INLINE

16-PIN  DUAL INLINE

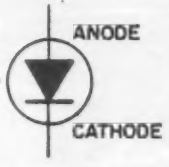
BIPOLAR TRANSISTORS

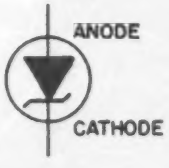


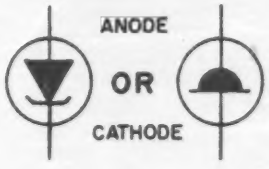
P.N.P. N.P.N.

SCR

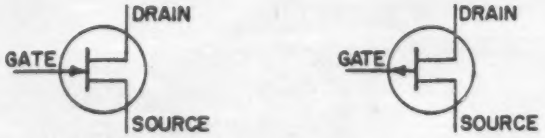
SEMI-CONDUCTOR DIODE

JUNCTION OR POINT CONTACT 

ZENER DIODE 

TUNNEL DIODE 

FIELD EFFECT TRANSISTORS (FET)



N-CHANNEL P-CHANNEL

RESISTOR COLOR CODES AND USE OF THE OHMMETER

Objectives:

1. To acquire skill in identifying the value of resistors marked with the standard EIA color code.

2. To acquire skill in the use of the ohmmeter for resistance measurements.

Equipment and Supplies Needed:

An assortment of carbon resistors identified by the EIA color code.

An ohmmeter of either the Volt-Ohm-Milliammeter (VOM) or the Vacuum Tube Voltmeter (VTVM) type.

Preliminary Information:

The EIA color coding system is based on the table below which lists the ten colors used and their number equivalents. You should memorize these color-number equivalents.

RESISTOR COLOR CODE

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	TOLERENCE
BLACK	0	1	
BROWN	1	10	
RED	2	100	
ORANGE	3	1,000	
YELLOW	4	10,000	
GREEN	5	100,000	
BLUE	6	1,000,000	
VIOLET	7	10,000,000	
GRAY	8	100,000,000	
WHITE	9	1,000,000,000	
GOLD		0 1	5
SILVER		0.01	10
NO COLOR			20

Lab Procedure: A (Resistors)

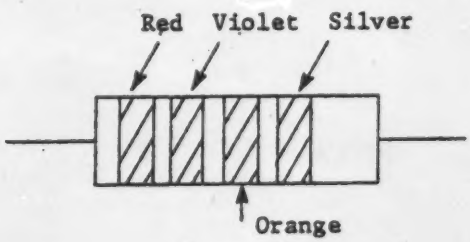
All axial lead EIA coded resistors bear at least 3 color bands and may bear a silver or gold band indicating the "tolerance", or accuracy of the resistor. Many resistors also have a fifth band indicating that they meet certain military specifications.

The resistor should first be turned so that the end bearing the color bands is to one's left; the resistor's value in ohms is then read from left to right as follows:

The first band (nearest the end) indicates the first significant figure, the second band the second significant figure, while the third band tells how many zeros follow these two digits.

A following silver band indicates the resistor is ± 10% of the value marked; a gold band, ± 5% of the value marked; and the lack of a silver or gold band indicates a tolerance of ± 20% of the marked value. Note that the tolerance stripe does not enter into the calculation of the value of the resistor.

An example follows:



Reading from left to right, the red band indicates the first significant number as 2; the violet band, the second significant number as 7. The orange band indicates the number of zeros that follow the first two digits, in this case, three zeros. The value of the resistor is then 27,000 ohms plus or minus 10%, the tolerance indicated by the silver band.

When resistors are less than 10 ohms, a modification of this system is used. The third band is always silver or gold. Silver indicates the first 2 digits are to be multiplied by the factor .01, gold by 0.1; for example, a resistor reads from left to right: brown, red, gold, silver. This indicates a value in ohms of 12 x 0.1, or 1.2 ohms ± 10%.

Wattage of a resistor is not directly related to its value in ohms but rather to the type of material it is constructed of and to its physical size which affects its ability to radiate heat.

Lab Procedure: B (Resistors)

List the values of the following resistors:

1. Yellow-violet-black-silver_____ _____
2. blue-gray-black-gold _____ _____
3. red-red-brown-silver _____ _____
4. yellow-violet-brown _____ _____
5. brown-black-red-gold _____ _____
6. brown-gray-red _____ _____
7. red-red-red-gold _____ _____
8. yellow-yellow-orange _____ _____
9. brown-black-yellow _____ _____
10. brown-black-green-silver_____ _____

Color-code the following resistors:

1. 56 ohms ± 10% _____ _____ _____ _____
2. 240 ohms ± 20% _____ _____ _____ _____
3. 2,700 ohms ± 5% _____ _____ _____ _____
4. 39,000 ohms ± 20% _____ _____ _____ _____
5. 120,000 ohms ± 10% _____ _____ _____ _____
6. 240,000 ohms ± 5% _____ _____ _____ _____
7. 300,000 ohms ± 10% _____ _____ _____ _____
8. 510,000 ohms ± 20% _____ _____ _____ _____
9. 1.2 megohms ± 5% _____ _____ _____ _____
10. 2.0 megohms ± 10% _____ _____ _____ _____

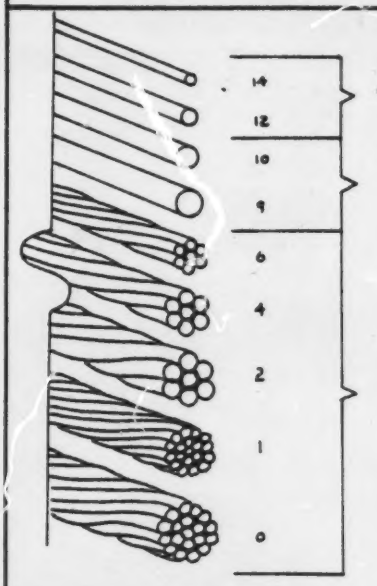
Lab Procedure: C (Resistors)

I. Obtain a set of 10 resistors from your instructor.

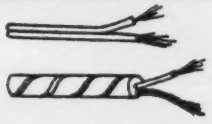
II. Measure each resistor carefully with an ohmmeter and record the color code, indicated value, and measured value in the table below.

	Color Code				Indicated Value	Measured Value
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

WIRE SIZE

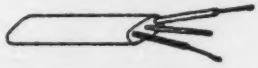


TYPE AND USE



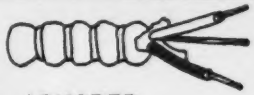
Used for lamps, appliances, etc. Available in light or heavy.

EXTENSION AND APPLIANCE CORDS



ROMEX

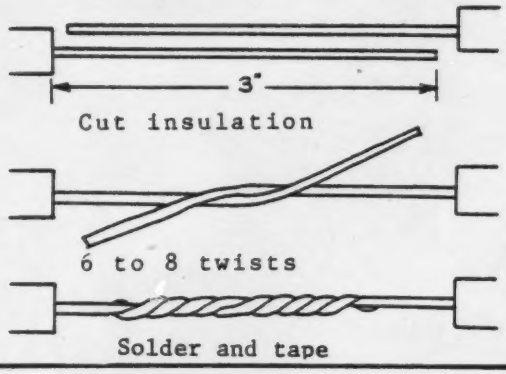
Resistant to water & corrosion. Use underground, above or inside.



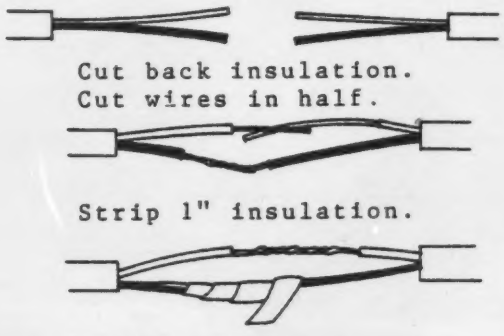
ARMORED CABLE

Copper wire. Use with steel junction and switch box. Use only indoors in dry location.

WIRE JOINING METHOD

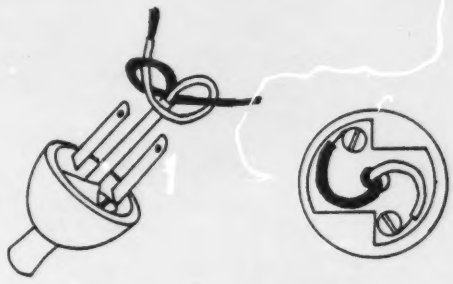


TWO-WIRE JOINING

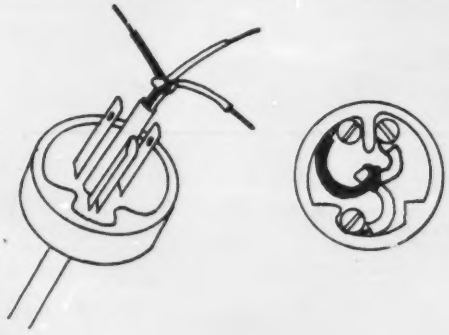


SPLICING CORD WIRES

PLUGS



TWO PRONG PLUGS



THREE PRONG PLUGS

FLEXIBLE CORDS

SPT

LAMP OR FIXTURE

HPN

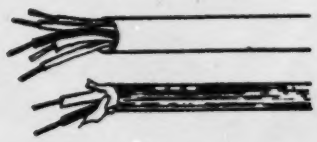
HPD

HEATER

SJT

SVT

POWER



CONDUITS

COUPLINGS

CONDUITS

CONNECTORS

RIGID STEEL

INTERMEDIATE METAL (IMC)

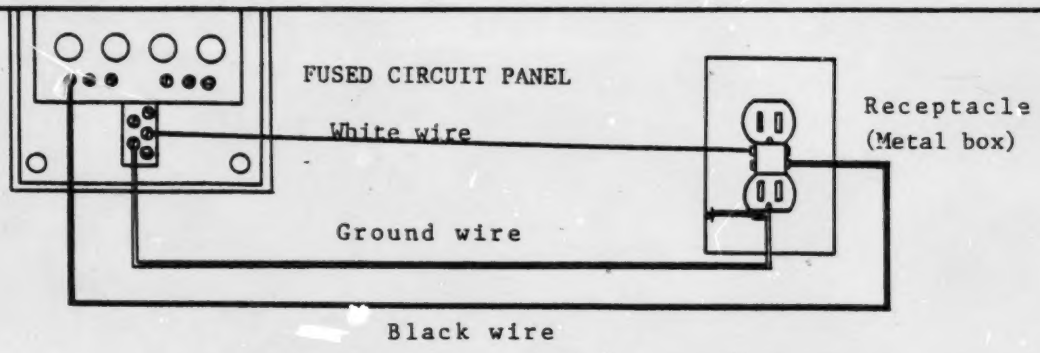
THINWALL METAL (EMT)

FLEXIBLE METAL

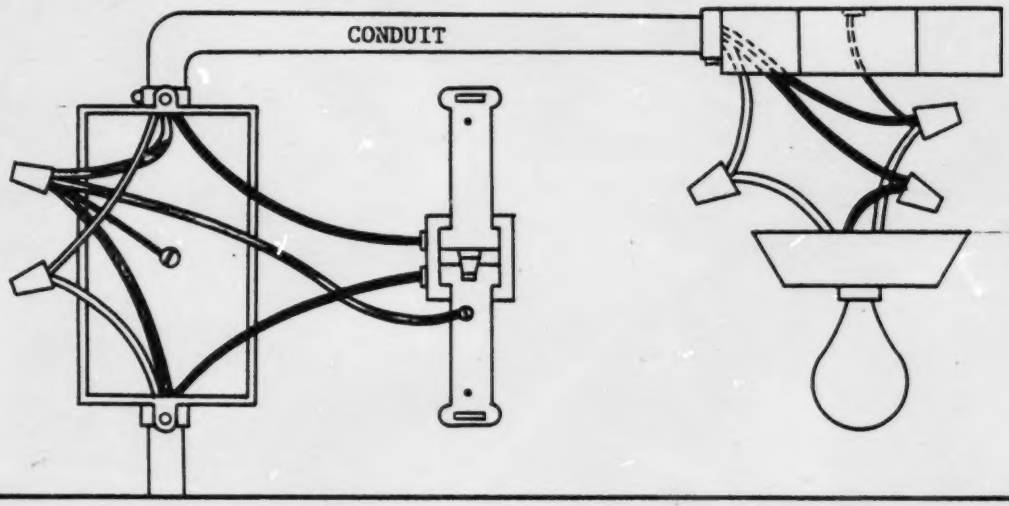
RIGID NONMETALLIC

SURFACE RACEWAY

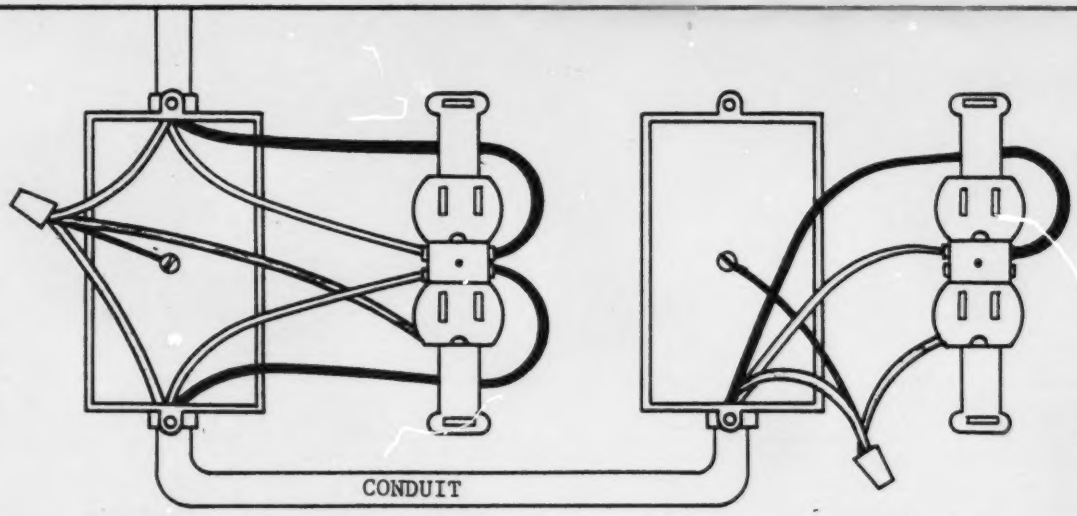
HOOKUP OF CIRCUIT AND RECEPTACLE

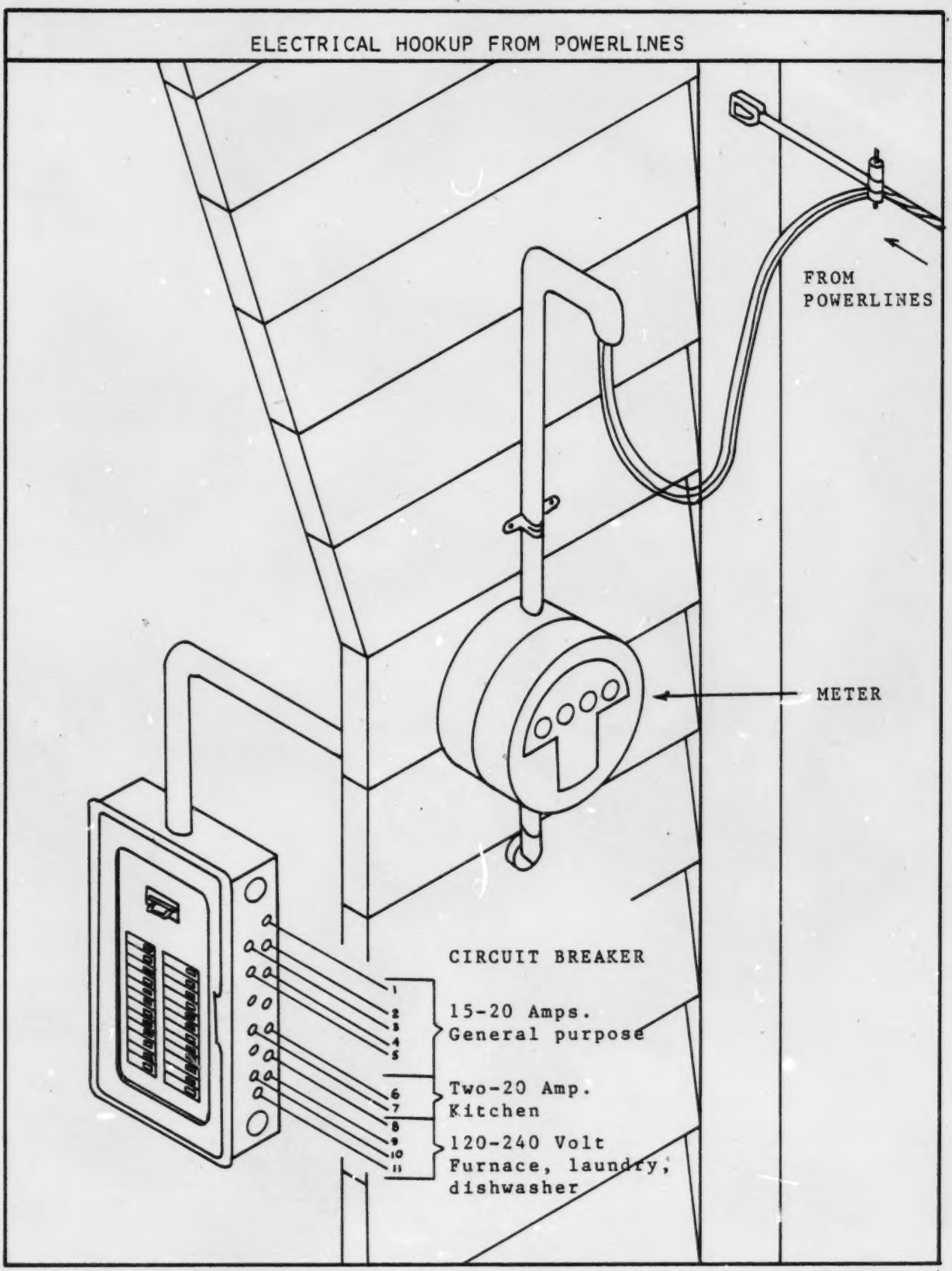


WIRING HOOKUP FOR LIGHT



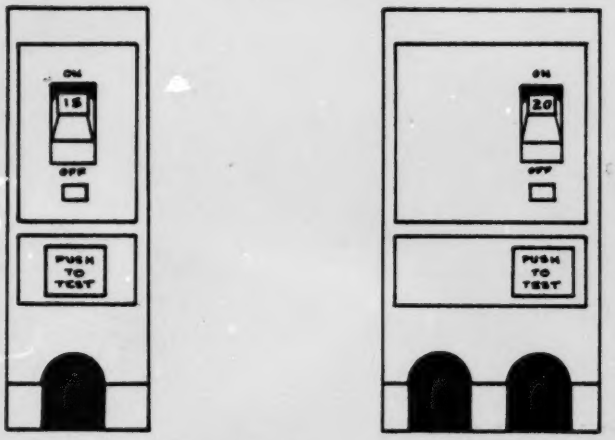
WIRING TO A NEW OUTLET



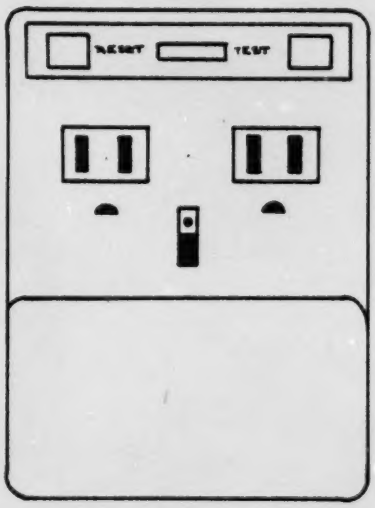

ELECTRICAL HOOKUP FROM POWERLINES
FROM POWERLINES
METER
CIRCUIT BREAKER
15-20 Amps. General purpose
Two-20 Amp. Kitchen
120-240 Volt Furnace, laundry, dishwasher

GROUND FAULT CIRCUIT INTERRUPTERS

CIRCUIT BREAKERS



Ground fault circuit breakers have ampere ratings of 15 to 30. These devices can be installed in circuit breaker panels in order to break electrical current when a path is established between an ungrounded conductor and ground. Full circuit breaker panels with this protection are also available.

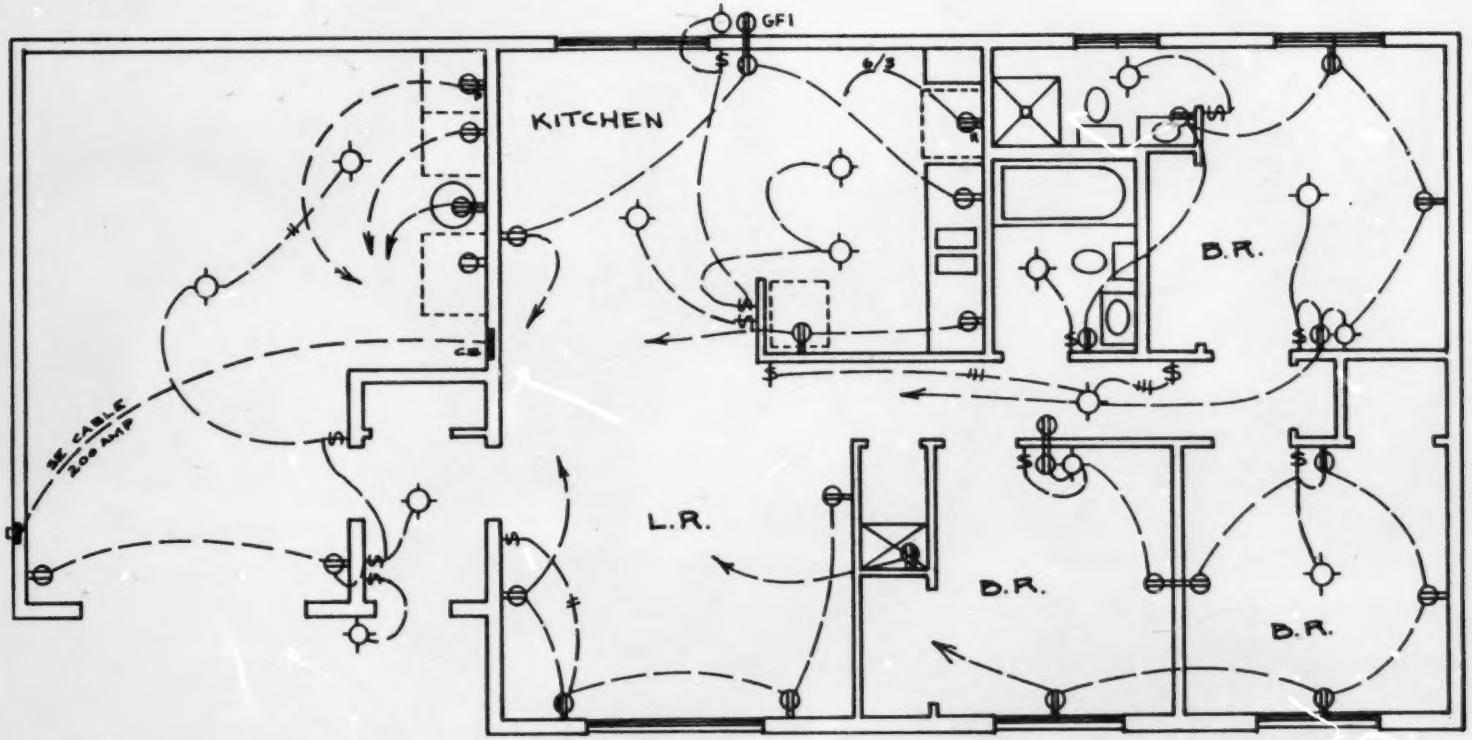


GROUND FAULT
PLUG-IN RECEPTACLE

GROUND FAULT
RECEPTACLE

These devices are available for protection at the point of installation. They can be connected to other downstream receptacles to provide further protection.

HOUSEWIRING SAMPLE



ELECTRICAL SYMBOLS

- LIGHT FIXTURE
- DUPLEX RECEPTACLE
- DUPLEX WITH HALF SWITCH
- S SINGLE-POLE SWITCH
- S_3 3-WAY SWITCH
- $\equiv_R$ RANGE OUTLET
- $\equiv_D$ DRYER OUTLET
- SPECIAL OUTLET
- DOOR BELL
- $\equiv_{GFI}$ GROUND FAULT INTERRUPTER
- ——— SWITCH WIRING

AVERAGE WATT USE

Baseboard heater	1600	Radio	100
Blender	300-1000	Range	8000-15000
Can opener	100- 215	Range top	4000- 8000
Coffee maker	850-1600	Range, oven	4000- 8000
Corn popper	600	Refrigerator, frostless	960- 1200
Crock pot	110-1600	Refrigerator, manual	750
Dishwasher	1100-1800	Sander, portable	550
Drill, portable	360	Saw, circular	1200
Dryer, clothes	5600-9000	Sewing machine	75- 150
Electric blanket	200	Shaver	12
Exhaust fan	175	Soldering iron	150
Freezer, frostless	1050	Steam iron	1100
Freezer, manual defrost	720	Stereo receiver	450
Frying pan	1250-1460	Stereo turntable	15
Furnace, fuel fired	800	Sunlamp	300
Garbage disposal	300- 909	Television, BW	250
Hair dryer	250-1200	Television, color	300
Heater, portable	1000-1500	Toaster	800- 1600
Hot plate, two burner	1650	Toaster oven	1600
Light, flourescent	15- 75	Trash compacter	1250
Light, incandescent	25- 200	Vacuum cleaner	250- 800
Microwave oven	975-1575	Waffle iron	1200- 1450
Mixer	150- 250	Washer, clothes	850
Projector	350- 500	Water heater	4000- 5000

ESTIMATING GUIDE

(120/240 volt service, 100 amp minimum)

Number of square feet in house X 3 watts equals 1_____

Number of 20 amp small appliance circuits X 1500 watts equals 2_____

Laundry circuit equals 1500 watts 3_____

Appliance use

- Water heater equals 4_____
- Dryer equals 5_____
- Dishwasher equals 6_____
- Range equals 7_____
- Shop equals 8_____
- Other equals 9_____
- Total equals (Add 4-9) 10_____

Total above equals (Add 1.2,3,and 10) 11_____

Multiply watts over 10,000 by 40% equals 12_____

Add heat (Number of watts equals) 13_____

TOTAL 14_____

Divide TOTAL by 240 volts to find required amps 15_____